

CFTRI-MYSORE



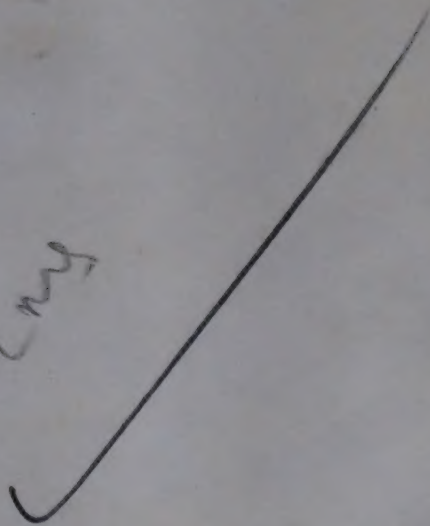
781

Marketing frozen

781

1. frozen food marketing
2. " " transportation
3. warehouses.
4. wholesale distributors
5. food delivery facilities
6. retail facilities.
7. food trades
8. " locker plants
9. home storage.
10. wholesaler plant

T. C. M.





Marketing **FROZEN FOODS** **-FACILITIES *and* METHODS**



By

J. STANFORD LARSON
JAMES A. MIXON
E. CLINTON STOKES

UNITED STATES DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION
MARKETING FACILITIES BRANCH

Washington, D.C.
June 1949



FOREWORD

Keeping food fresh and wholesome has always been one of the basic problems of man. For centuries methods of processing and marketing foods were little changed. However, in recent years, new techniques and methods of processing and handling food products have been developed. Important among these techniques are food freezing and the special marketing practices associated with frozen foods which are bringing about significant changes in the food preserving and distributing industries. Already the frozen-food industry has grown tremendously. More than 15,000 firms are engaged in producing, wholesaling, processing, distributing, warehousing, or other handling of frozen foods. The operations of these frozen-food enterprises will influence the methods and facilities used to distribute food generally.

To find out the kind of facilities being used for the handling of frozen foods and to discover some of the inadequacies of such facilities, and what types of facilities and methods of handling seem to be most efficient, the Marketing Facilities Branch made this study of the frozen-food industry, with consideration of each step through the marketing channel.

Many packing areas were visited, and the writers discussed with packers their facilities and observed their methods of operations. Numerous refrigerated warehouses were examined to learn what types of storage facilities might be best for frozen-food warehousing, and where in the marketing channel these facilities should be located to make distribution more efficient. More than 315 wholesale distributors were visited in 50 cities of key importance as terminal food markets. About 300 retail stores in all parts of the country were visited to study the use of various types of frozen-food display and storage cabinets.

Many primary distributors, brokers, and transportation agencies also were interviewed in order to complete the picture of frozen-food distribution and to enable better judgment in determining the type of marketing facilities needed. Wholehearted cooperation was extended by all members of the trade with whom the authors communicated.

This study has led to certain conclusions as to efficient and inefficient facilities and handling methods which are here set forth, and has uncovered many problems relating to frozen-food marketing facilities which should be investigated more closely at a later date.

Acknowledgments

Acknowledgment is made for valuable assistance with the chapter entitled "Transportation Facilities" to Harold D. Johnson, transportation specialist; with the chapter entitled "Locker Plants" to Johnson E. Hill, agricultural economist; and for the work on plant lay-outs, graphs, and charts to A. B. Lowstuter, architectural engineer, and his associates, all of whom are on the staff of the Marketing Facilities Branch.

CONTENTS

	<u>Page</u>
Frozen Foods -- A New Development in Marketing Perishables.....	1
Importance of refrigeration.....	1
Reasons for freezing foods.....	2
Foods that are frozen - growth of production.....	8
Where frozen foods are produced.....	16
Organization of the industry.....	23
Facilities used in the distribution of frozen foods.....	25
The Processor's Role in Marketing Frozen Foods.....	27
Frozen fruits and vegetables.....	27
Frozen poultry.....	33
Frozen meats.....	35
Frozen eggs.....	37
Frozen fish products.....	39
Other frozen foods.....	40
<u>Transportation Facilities.....</u>	42
Rail facilities.....	42
Truck facilities.....	52
Water transportation facilities.....	53
Air transportation.....	54
Method of transportation by which wholesalers receive frozen foods.....	54
Summary.....	56
<u>Warehouse Facilities.....</u>	57
Importance to frozen food distribution.....	57
The function of the warehouse in frozen-food distribution.....	57
The flow of frozen foods through refrigerated warehouses.....	61
Seasonal movement of frozen foods through warehouse storage...	68
Storage in public and private warehouses.....	73
Warehouse tariffs.....	75
Handling frozen food at the refrigerated warehouse.....	79
<u>The Wholesale Distributor.....</u>	83
Areas served.....	83
Location within the city.....	85
Number of years in business.....	86
Products, other than frozen foods, handled.....	87
Kinds of frozen foods distributed.....	89
Degree of affiliation with other distributors.....	89
Brands of frozen foods handled.....	90
Type of trade served.....	90
Facilities for unloading railcars and trucks at the wholesale plant.....	90
Wholesaler's plant.....	91
Handling equipment.....	94
Operations at the wholesale plant.....	94
Recommendations for a wholesaler's plant lay-out.....	97
Plant design.....	101
<u>Delivery Facilities and Methods.....</u>	106

Methods of delivery.....	106
Sales methods.....	106
Time from sale to delivery.....	107
Delivery routes.....	108
Types of trucks used.....	109
Size of trucks used.....	109
Number of trucks.....	109
Various uses of delivery trucks.....	110
Design of trucks used.....	110
Factors which affect the use of refrigerated delivery facilities.....	113
Ownership of delivery facilities.....	120
Frozen-food shipping containers.....	120
Retail Facilities.....	122
Types of retail stores.....	122
Home deliveries.....	124
Expansion of retail sales.....	126
Cabinet design.....	129
Location of frozen-food cabinets in the retail store.....	131
Retail-wholesale relations.....	133
The position of brand names in the retail store.....	136
Institutional and Industrial Facilities.....	137
Description of the trades.....	137
The role of the wholesaler in supplying the bulk trades.....	138
On-premise storage units.....	140
Locker Plants.....	143
History of development.....	143
The geographical distribution of locker plants.....	145
Predominance of plants in rural communities.....	145
Plants in urban areas.....	146
Processing services.....	148
Other operations of the plant.....	153
Plant lay-out.....	154
Home Storage Facilities.....	159
Importance.....	159
Extent of freezers in homes.....	159
Servicing the home freezer.....	160
Future possibilities for home-cabinet use.....	162
Use of freezers in urban homes.....	165
Use of freezers in rural homes.....	166
Some factors to consider in purchasing a freezer.....	167
Conclusions.....	170

✓781

G168

F8, 3-0 (a6:c) ; (X: 51)

CFTRI-MYSORE



781

Marketing frozen

N49

MARKETING FROZEN FOODS--FACILITIES AND METHODS

By J. Stanford Larson, marketing specialist, and James A. Mixon and E. Clinton Stokes, agricultural economists, Marketing Facilities Branch

FROZEN FOODS--A NEW DEVELOPMENT IN MARKETING PERISHABLES

Importance of Refrigeration

A major factor in making more produce available on the market has been the development of the science of refrigeration. We are inclined to overlook the importance of refrigeration in this respect and to take for granted the large variety of fresh foods that are available throughout the year. We need to look back only 50 years to a time when such a wide choice would have been impossible. Then, such foods as fresh tomatoes, berries, and leafy vegetables were available only during seasons of local production.

The importance of refrigerated facilities to "good eating" can scarcely be overemphasized. They are an indispensable part of our Nation's food-distribution system. According to our present marketing methods about one-half of all foods should be kept under controlled temperatures from the time they are harvested until the time they are to be prepared for the consumer's table. ^{1/} Without refrigeration many essential items, such as fresh milk, meats, eggs, and a sizable quantity of fruits and vegetables, could not reach consumers through our established marketing channels. Even commodities that are not highly perishable suffer much spoilage and waste when exposed to extreme temperature conditions, with the result that the amount added to the cost of marketing them is considerable. In the earlier use of the science of refrigeration as applied to food marketing the procedure was to construct facilities for the storage and transportation of products in their natural state. Thus the vast numbers of refrigerated warehouses and railroad cars that we have throughout the country today were constructed.

The first cold-storage warehouses consisted mostly of cooler space; that is, rooms which were held at temperatures above freezing, usually ranging from 32° to 50° F. This type of space is used for storing such products as potatoes, fresh apples, and cheese, and for holding shell eggs for a limited time. The spoilage and deterioration of items held within this temperature range are arrested. In the early days of the refrigerated warehouse, a smaller amount of storage was built to include space which could be held at freezer temperatures. In the beginning,

^{1/} Compiled from figures in Census of Retail Trade 1940. In combination grocery stores with annual sales of \$20,000 or more, the sales of meats, sea food, poultry, fresh fruits and vegetables, eggs, and dairy products, amount to 47.4 percent of sales volume.

the principal use made of this type of space was to store such commodities as meats, poultry, and fish which were later thawed for selling. Although this method of preserving perishable foods was a most valuable development in the field of food distribution, it nevertheless proved to be only the forerunner of the application of refrigeration to other uses. Experiments proved that through the method of freezing, foods could be processed into a form which would maintain their quality while they were being marketed. This brought about the next step in the development of the frozen-food industry known as cold packing and which at first (about 1918) was applied principally to fruits. "Cold packs," as they were called, were put up in large containers, frequently barrels, and were frozen slowly for 2 or 3 days at temperatures from 10° to 15° F. They were used mostly by preservers, ice cream manufacturers, bakers, and other industrial users.

Although the principle of quick-freezing had been known for many years, no commercial use had been found for it. But, by 1930, techniques of preserving food by freezing and marketing the frozen products had developed to the point where they had definite commercial possibilities insofar as distribution through retail channels and sale directly to the consumer are concerned. This new method of freezing foods was referred to as quick-freezing, as distinguished from cold packs and other freezer storage items. As implied, the term "quick-freeze" is derived from the manner of freezing the product rapidly. Its chief advantage is that in the process of freezing the crystals that are formed are very small and the cell walls of the product are not destroyed.

Reasons for Freezing Foods

As has been implied, to prove that something is scientifically feasible is not enough to make it economically significant. First, it must be demonstrated that the principle is commercially practicable. Therefore, even though it may be established that foods can be preserved by freezing, the question immediately arises as to what reasons there are for doing so. Probably the foremost reason for freezing certain foods rather than preserving them in some other manner is to retain the original "freshness" of the product as nearly as possible. Consumers often say if you want something "really good to eat" pick a fully ripe apple off the tree, get a "mess" of green peas right out of the garden, or fry a "just-killed" young chicken. This implies that there is nothing like freshness in foods to make them delicious. Freshness, along with other quality characteristics, is, of course, very important. Unfortunately, it is a physical impossibility for any appreciable amount of the billions of pounds of foodstuffs that are eaten daily in this country to reach the consumer without some delays incident to the processes of marketing. These delays all present certain hazards to the inherent natural qualities of the product. Unless proper facilities are provided at all stages of marketing, flavor and some of the vitamins are lost, spoilage and waste ensue, and appearance of the product suffers. Therefore, one of the major aims of marketing is to devise better facilities for getting food to the consumer in first-class condition or for putting food in a form in which it is least susceptible to change in quality, thus maintaining the natural qualities it has when harvested.

Freezing has proved to have some distinct advantages for preserving the fresh qualities of many commodities. Quick-frozen foods are processed near the seat of production. This fact has been particularly important in the marketing of certain products which are of a highly perishable nature. Food technologists tell us that when foods are frozen and then handled through proper marketing facilities they lose very little of their nutritive values.

If it is assumed that the frozen product is as fresh as its "fresh" counterpart, other important factors to be considered in making food purchases are:

1. Convenience of preparation.--Much of the "kitchen work" has been done in the processing plant. The market for fresh peas, for example, has been hampered by the laborious and time-consuming task of shelling. Frozen peas come in a convenient-sized package ready to be emptied into the cooking vessel. Little needs to be done in the way of preparation. Convenience to the housewife is an asset of frozen foods and has been a major factor in bringing about their consumer acceptance.

2. Variety to the menu.--An important reason for freezing foods is to give a greater range of products from which the consumer may choose, particularly during seasons when many fresh foods cannot be had on the market. The freezing of foods also makes it possible to stock highly perishable items in the retail stores that ordinarily would not be kept in supply in very large quantities at times when they are not locally grown. "Strawberries in January" are rapidly passing out of the extreme luxury class.

3. Keeping qualities.--If proper facilities are available for storing frozen foods--such as home freezer cabinets or freezer compartments in refrigerators--they can be kept for a considerable length of time without in any way losing their quality.

Even though a consumer finds a commodity acceptable and is willing to purchase it, the fact does not necessarily follow that the product will be placed on the market. There are several things the farmers and the people engaged in distribution will take into consideration before producing and marketing a new item. The first and most obvious reason for anyone being engaged in any phase of the production or marketing of frozen foods is to make a profit. This means that the volume must be large enough and the cost of marketing low enough that frozen products can be sold to the consumer at a price which she is willing to pay, and at the same time allow for reasonable returns to the producer and to those who are engaged in the essential marketing services. However, the picture becomes much more complicated than this would indicate. There enter into it questions of the possible substitution of competitive products and other factors which have an influence in determining whether or not a commodity is to be marketed. These factors are not considered in this discussion because they require a much more detailed analysis than can be given without further study. Nevertheless, there are several factors summarized below that make the marketing of foods in frozen form attractive to the food industry.

Table 1.-- Percentage of farm weight of certain products
which is left at the source of production when frozen

Commodity	:	Trimming and peeling loss
		Percent by weight
Apples	:	50
Apricots	:	22
Asparagus	:	54
Beans, green	:	21
Beans, lima	:	63
Blackberries	:	5
Broccoli	:	45
Brussel sprouts	:	45
Cauliflower	:	70
Cherries, pitted	:	25
Corn, sweet, cut	:	76
Oranges, (for juicing)	:	<u>1/</u> 60
Peaches	:	33
Peas, green	:	60
Rhubarb	:	15
Spinach	:	45
Squash, yellow	:	35
Strawberries	:	7
Beef, carcass	:	29
Eggs	:	--
Fish, whole	:	21
Poultry, live	:	38

1/ Concentrated orange juice, reduced $3/4$, would result in leaving about 91 percent of the product at the point of harvest.

Source: Conversion Factors and Weights and Measures for
Agricultural Commodities and Their Products, U. S. Dept. Agr.,
Production and Marketing Administration, 1947.

1. Inedible portions left at point of production.--Large portions of foods produced on the farm are inedible. Table 1 shows an estimated percentage of loss through trimming and peeling of several important fruits and vegetables which are commonly frozen. It will be noted that the part of the product which is considered inedible ranges from 5 percent in the case of blackberries and currants to 76 percent in the case of corn. Likewise a significant part of poultry is inedible. It is estimated that a chicken eviscerated and ready for the pan has lost about one-third of its live weight. When inedible portions are left at the

source of production, it is frequently possible to utilize them as by-products. (See fig. 1.) On the other hand, carrying them all the way through the marketing channels adds unnecessarily to the handling costs.

2. Storage life of perishable products lengthened.--Many fresh farm products, particularly the fresh fruits and vegetables, can be held in storage for limited periods. Even when held under cooler refrigeration, some deterioration in quality and loss of nutrients are constantly taking place. Therefore, the "selling" life of these perishables is short, which in turn may mean greater risks and smaller profits to those who produce and market them. This tends to make food distribution and production enterprises highly speculative.



Figure 1.--When foods are frozen, portions that are normally wasted can be left at the point of production and converted into a usable product. In the process above, orange skins are being shredded for use in livestock feed.

On the other hand, frozen foods when held at zero temperatures can be kept for long periods without noticeable loss of their inherent values. The length of the storage life of each frozen item depends upon the nature of the product and upon the temperature at which it is held. (See table 2.) Research in the past 8 or 10 years has been successful in finding new ways and means of increasing the storage life of frozen commodities, and also in discovering improved methods of reducing the amount of change that takes place in the product from its original form. It is likely that further research in this field will continue to improve on present methods and techniques.

3. Transportation costs reduced.--Although facilities for transporting frozen foods are far from adequate, considerable savings in transportation cost can be made by freezing foods and leaving the trimmings, peelings, and other inedible portions at points of production. (See table 3.) For instance, frozen vegetables can be marketed at less than one-third the cost of shipping the edible equivalent in fresh weight. In considering volume, the edible portions of five carloads of fresh vegetables can be shipped in one. Part of this difference is due to the compactness of frozen merchandise which permits greater weight-load and part is due to the elimination of inedible portions. The edible portion of fruits can be shipped in the frozen form at two-thirds the cost of shipping the fresh equivalent.

One refrigerated rail car loaded with poultry that is dressed and frozen will transport as much edible poultry meat as two cars filled with

Table 2.-- Approximate storage life of certain frozen foods
at various temperatures ^{1/}

Product	Temperature		
	^{2/} +10° F.	0° F.	-10° F.
	Months	Months	Months
Poultry giblets	1	3-5	8-10
Poultry, roasting	4	8-10	12-15
Pork sausage	2	4-6	8-10
Pork roasts	4	8-10	12-15
Beef roasts	6-8	16-18	18-24
Lamb	5-7	14-16	16-18
Lobster	3-4	8-10	10-12
Cooked shrimp	3-4	8-10	10-12
Raw shrimp	6	12	16-18
Fatty fish	4	6-8	10-12
Lean fish	6	10-12	14-16
Mushrooms	3-4	8-10	12-14
Corn-on-cob	4-6	8-10	12-14
Asparagus	4-6	8-12	16-18
Snap beans	4-6	8-12	16-18
Brussels sprouts	4-6	8-12	16-18
Peas, cauliflower, broccoli, spinach, lima beans	6-8	14-16	24 :(or longer)
Squash, pumpkin, sweet corn, carrots	12	24	36 :(or longer)
Peaches, in paperboard cartons, without ascorbic acid	3-4	8-10	12-14
Apricots, in paperboard cartons, without ascorbic acid	3-4	8-10	12-14
Peaches, in paperboard cartons, containing ascorbic acid	6-8	18-24	24
Apricots, in paperboard cartons, containing ascorbic acid	6-8	18-24	24
Raspberries, without sugar or sirup	6-8	12	18
Raspberries, with sugar or sirup	8-10	18	24
Sliced strawberries	8-10	18	24

^{1/} The storage periods indicated in this table are the average lengths of time that the several products may be held without noticeable change in quality. Numerous factors other than storage temperature have an important influence in determining the keeping quality of frozen foods, the more important of which are the following: Variety (of fruit or vegetable), degree of saturation of fat (meats, poultry, and fish--determined by the feed of the animal, etc.), treatment given the product prior to freezing, freshness (all products), severity of blanch (vegetables), and chilling, method of packaging, and rate of freezing.

Source: Dr. Donald K. Tressler, consultant, Westport, Conn., *Ideal Temperatures for Storing Frozen Foods*, Ice Cream Field, Vol. 47, No. 4, April 1946, see p. 74-75, I.C.F. Publishing Company, N. Y.

^{2/} It is generally conceded as pointed out by Dr. Tressler in the article referred to above that +10° is not a desirable temperature to store most of the foods listed.

Table 3.--Comparative cost, based on railroad charges for shipping certain fruits, vegetables, poultry, meats, and fish in both fresh and frozen form 1/

Commodity <u>2/</u>	Amount to		Refrigerated	Freight		Estimated		Total cost		Trans. cost per	
	ship to get 1	car of edible		cars	required <u>4/</u>	rate per	tion cost	per car	per car	1,000 lbs. of	edible mdse.
	Lbs.	No.		Dol.		Dol.			Dol.		Dol.
Fruits											
Frozen	53,000	1		1.61		157.30		1,010.60		19.07	
Fresh (decid.)	68,000	2		1.83		125.64		747.84		28.22	
Vegetables											
Frozen	46,000	1		1.61		157.30		1,010.60		19.07	
Fresh	106,000	5		2.17		105.20		565.24		61.00	
Poultry											
Frozen - evisc.	20,000	1		1.31		90.00		352.00		17.60	
Frozen - N.Y. dr.	28,000	1		1.31		90.00		456.80		22.84	
Live	32,000	2		1.48		None		236.80		23.68	
Beef											
Frozen - boneless	21,000	1		1.30		90.00		363.00		17.29	
Frozen - carcass	29,000	1		1.30		90.00		467.00		22.24	
Fish											
Frozen - fillets	44,000	1		3.10		140.00		1,504.00		34.18	
Frozen - dressed	60,000	2		3.10		140.00		1,070.00		48.64	
Fresh - whole iced	88,000	4		4.93		None		1,084.00		98.55	

1/ Rates for fruits and vegetables are from California, Oregon, and Washington to New York City as of Jan. 10, 1949. Rates for poultry, beef, and fish are from Chicago to New York as of Jan. 10, 1949.

2/ Based on products that are commonly frozen.

3/ Ratios based on "Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products," Production and Marketing Administration, U. S. Dept. Agr., 1947.

4/ Shipping weights equal to or above the minimum per car are used.

5/ Average for several vegetables.

6/ Rate on express shipment.

live poultry. Table 3 also shows that it costs less per 1,000 pounds of edible weight to ship eviscerated poultry than to ship poultry that is only New York dressed. When poultry is eviscerated it is reduced to about two-thirds of the live weight and three-fourths of the dressed. Furthermore, it can be packed into small and compact containers.

Savings both in space and transportation cost are realized by dressing fish at the point of catch and shipping them to market in the frozen form. Frozen fish fillets can be shipped for less per pound of edible weight than when shipped frozen dressed or fresh-whole-iced. One carload of frozen fillets represents the same amount of edible fish as two carloads of frozen dressed, and nearly four carloads of fresh-whole-iced.

As yet, very little meat is boned, frozen, and shipped in retail sized packages. However, if it is assumed that a refrigerated car will carry the same weight of these retail cuts as the minimum weight for carcass beef, boneless cuts can be transported for less per pound of edible product than the carcass meat with the bone in. The compactness of packaged cuts usually permits greater efficiency of car space.

4. Ease of handling at the wholesale store.--The compactness of frozen foods makes them relatively easy to handle at the wholesale plant (table 4). Frozen foods, as a rule, do not require conditioning, re-packing, washing, sorting, and ripening. Also frozen foods usually have uniformity of package size and design. The distributor does not have to contend with a complexity of boxes, hampers, sacks, crates, and baskets.

5. Efficient use of delivery equipment.--Because frozen food is compact a good deal can be placed on a truck. One delivery truck will usually service 40 to 50 retail stores in a day.

6. Ease of handling in retail stores.--Frozen foods come to the retailer packed and ready for the consumer. This apparently reduces the handling job in the retail store largely to keeping cabinets stocked and the merchandise in them orderly. Also frozen foods usually occupy relatively less floor space in the retail store. How much space depends on the size and design of the cabinet (a wall cabinet will occupy less floor space than a chest model) and the type of foods marketed (frozen orange concentrate requires only about one-twelfth of the space needed for fresh fruit to supply an equivalent amount of juice).

Foods that are Frozen - Growth of Production

In speaking of frozen foods, reference is generally made to seven commodity groups. They are: Fruits, vegetables, poultry, meats, eggs, sea-foods, and cooked and other specialty foods. Ice cream and frozen cream

Table 4 -- Comparison of densities of selected commodities commonly marketed in fresh and frozen form

Item	Type of package	Density	
		Net wt. of edible mdse. 1/	per cu. ft. of edible mdse. net wt.
		Pounds	Pounds
Beans, lima - unshelled	:Bushel (32 lb.)	: 12	: 9.60
frozen	:Carton (12/3-lb. pkgs.)	: 36	: 30.55
Carrots, bunched	:Western crate (75 lbs.)	: 38	: 13.35
frozen	:Carton (30 lbs.)	: 30	: 27.40
Cauliflower - fresh	:1½ bushel crate (37 lbs.)	: 11	: 6.00
frozen	:Carton (36/10-oz. pkgs.)	: 22½	: 21.95
Cherries (red sour)	:Bushel (56 lbs.)	: 42	: 33.85
frozen RSP	:30-lb. can	: 30	: 41.50
Corn, green sweet (on cob)	:Bushel (35 lbs.)	: 9	: 7.25
frozen, cut	:Carton (36/12-oz. pkgs.)	: 27	: 26.40
Oranges - fresh	:Box (90 lbs.)	: 9 2/	: 4.50
frozen, concen.	:Carton (48/6-oz. cans)	: 18	: 17.50
Peaches - fresh	:Bushel (48 lbs.)	: 32	: 25.80
frozen	:30-lb. can	: 30	: 41.50
Peas, green - unshelled	:Bushel (30 lbs.)	: 12	: 9.60
frozen	:Carton (48/12-oz. pkgs.)	: 36	: 27.25
Raspberries, fresh, black	:24-qt. crate (34 lbs.)	: 33	: 41.25
frozen	:Carton (24/1-lb. pkgs.)	: 24	: 36.25
Spinach - fresh	:Bushel (18 lbs.)	: 10	: 8.10
frozen	:Carton (12/2½-lb. pkgs.)	: 30	: 31.40
Strawberries - fresh	:24-qt. crate (36 lbs.)	: 33	: 41.25
frozen	:30-lb. can	: 30	: 41.50
Poultry, fowl, N.Y. dressed	:Wood box	: 51	: 28.18
frozen, cut	:Box	: 21	: 41.30
Unweighted ave. - fresh	:--	: --	: 19.06
frozen	:--	: --	: 32.04

1/ Based on Conversion Factors and Weights and Measures for Agricultural Commodities and their Products, U. S. Dept. Agr., Production and Marketing Administration, August 1947, and unpublished data. Marketing Facilities Branch.

2/ Concentrate equivalent (3-1).

are also frozen foods but are frequently omitted when referring to the industry. Each of these classifications presents its own special problems in techniques of freezing and facilities for handling, and the growth of different phases of the industry has been affected accordingly. However, during the past few years, pronounced developments have taken place in the production of all commodity groups.

Just how rapidly the industry has grown within the past few years is indicated in table 5, which shows production at 5-year intervals starting in 1937 (the date most frequently used as the beginning of frozen foods as an integrated industry), 1942, the first year of our entry into the war, and in 1947.

Table 5.--Growth of frozen food production - 1937, 1942, 1947

Commodity	Year		
	1937	1942	1947
	Million pounds		
Fruits	111	220	370
Vegetables	72	163	345
Poultry	12	70	128
Seafood	40	70	125
Eggs	116	258	371
Meats	1/ 5	12	20
Cooked and other specialty foods	--	.5	22

1/ Production for 1938.

Source: Fruits, vegetables, and eggs 1937 and 1942 taken from Agricultural Statistics - 1947. Other products for 1937 and 1942 taken from the Directory of Frozen Food Processors, Quick Frozen Foods, 1948, E. W. Williams Publications, Inc., 82 Wall Street, New York, N. Y. Figures for 1947 compiled in conjunction with National Association of Frozen Food Packers.

Fruits.--An inspection of the list of fruits that make up the frozen commercial pack reveals several things which are generally true of the various items included. (1) Most of them are fruits which are highly seasonable, that is, they are on the fresh market only for short periods during the year. (2) They are products of an extremely perishable nature. (3) Of the 19 fruits that make up the bulk of the frozen fruit pack, 8 are berries. Until 1942, berries made up by far the greater part of the total. However, other frozen fruits have increased rapidly in volume, and today berries comprise only about one-half of the frozen fruits. (See table 6.)

Two other items which made up a sizable part of the frozen food pack in the beginning were cherries and grapes. In 1937, these two fruits, together with strawberries, raspberries, and blackberries, totaled 89 percent of all fruits frozen. In 1947, these five items made

up 70 percent of the total fruit pack. During the past few years, the production of frozen apples and peaches has jumped from 3,266,000 pounds, or less than 3 percent of the pack to 55,607,000 pounds, or about 16 percent of the total. The greatest percentage increase in fruits in the past few years has been in the production of orange juice. It is estimated that in 1948 more than 50,000,000 pounds (single strength equivalent) were produced. This is several hundred percent above the 1946 pack.

Table 6.-- U. S. frozen fruit packs showing the quantities of berries packed in relation to other fruits, 1937-48

Year	Berries	Other fruits	Total	Proportion of berries to total fruits
	Thousand pounds	Thousand pounds	Thousand pounds	Percent
1937	66,506	44,837	111,343	60
1938	76,538	52,647	129,185	59
1939	79,259	61,359	140,618	56
1940	105,557	66,887	172,444	61
1941	122,873	84,930	207,803	59
1942	103,300	117,100	220,400	47
1943	72,500	141,600	214,100	34
1944	91,300	249,700	341,000	27
1945	99,363	330,814	430,177	23
1946	158,809	364,472	523,281	30
1947	185,053	184,901	369,954	50
1948	218,843	208,817	427,660	51

Source: Agricultural Statistics 1947, U. S. Dept. Agr. Figures for 1947 and 1948 supplied by National Association of Frozen Food Packers. (Estimate of orange juice concentrate equivalent added for 1947 and 1948.)

All of the early production of frozen fruits was put up in containers holding more than 1 pound for use by the institutional and industrial trades. Sizes of containers were not too consistent. They ranged from $2\frac{1}{2}$ pounds to 10 pounds for the smaller sizes and from 30-pound and 50-pound cans to large barrels for the larger sizes. As the retail trade grew from 1933 on, it became necessary to put up more fruits in packages weighing 1 pound or less to meet this new demand. In 1942, about 9 percent of the frozen fruit packed was in retail-size packages. By 1947, the proportion of retail sizes had increased to 16 percent of the total. (See table 7.)

Vegetables.--Frozen vegetables did not enter the commercial market until 1933. In that year the pack was less than 5 million pounds. The next 4 years saw only a small growth in production, for during this period the industry was passing through a stage of experimentation. In the year 1937, the output increased to 72 million pounds. In 1948, the total quantity of vegetables frozen was much greater than for fruits.

Table 7.-- Percentage of change in production of frozen fruits and vegetables, according to package size, 1942-47

Size of package ^{1/} :	Fruits			Vegetables		
	1942	1947	Change	1942	1947	Change
	: Million	: Million	: Percent	: Million	: Million	: Percent
	: pounds	: pounds	:	: pounds	: pounds	:
Retail	: 17	: 54	: +218	: 58	: 202	: +250
Semi-institutional:	10	7	- 30	67	91	+ 36
Institutional	: 167	: 286	: + 71	: 28	: 52	: + 86
Total pack	: 194	: 347	: + 80	: 153	: 345	: +125

^{1/} Retail - package of 1 lb. or less.

Semi-institutional - over 1 lb., less than 30 lbs.

Institutional - 30 lbs. or over

Source: Production figures taken from annual reports of the National Association of Frozen Food Packers.

All together there are approximately 43 kinds of vegetables that have been frozen. However, many of these are such products as peppers and eggplants, which might be classified as specialty items insofar as general use is concerned. Of the 15 vegetables most commonly frozen, peas and lima beans have been the leaders ever since packing got under way. These two items made up about 85 percent of the frozen vegetables packed in 1937. Asparagus, snap beans, and corn were also among those commodities that were packed early in the history of this segment of the industry. In 1948, while they had increased considerably in total pack, the proportion of the pack made up by peas and lima beans was reduced to 43 percent. This had come about through decided increases of all vegetables packed.

In the beginning, frozen vegetables were packed predominately in retail-and small institutional-size packages (less than 10 pounds). In 1942, the retail packages (1 pound or less) amounted to 38 percent and the small institutional packages to 44 percent of the total. The growth of production of frozen vegetables during the following 10 years was largely the result of the increase in the output of retail packages, which jumped from 53 million pounds in 1942 to 202 million pounds in 1947.

Poultry.--Looking back through the history of poultry marketing, the common way of obtaining poultry was, for a long time, to purchase it alive, take it home, kill and dress it, or wait at the retail store for the butcher to prepare it. Although poultry was frozen successfully before the turn of the century, the amount eviscerated and frozen has been small until recent years. Prior to 1940, practically all frozen chickens were of the New York dressed type; that is, blood and feathers were removed and the bird was frozen with the entrails left in. At that time only 13 of the 100-odd poultry processors were putting

out quick-frozen packs. But during 1940, production more than doubled that of the previous year and by 1942 it had gained another 80 percent. During World War II the production of frozen poultry for domestic use did not increase as did the production of some other frozen foods.

Statistics on the production of quick-frozen poultry are not available as such. But since nearly all the quick-frozen poultry is eviscerated, Federal inspection reports on this type of poultry give some indication as to the total output. Most of the large packers are believed to make use of the inspection service, and it is estimated that more than three-fourths of inspected poultry is quick-frozen. ^{2/} Table 5, page 10, shows an increase from 12 million pounds in 1937 to 128 million pounds in 1947.

Meats.--Freezing has been important in the marketing of meats since the latter part of the nineteenth century. It was first used as a means of preserving meats while in transit--particularly in international commerce. In shipping beef from the great livestock producing countries of South America and mutton from Australia to Europe, the freezing process assumed major importance.

Yet, even though it has been a trade practice to freeze carcasses and wholesale cuts of meats for some time, the frozen packaged retail cuts of meat are one of the newer developments in the frozen food industry. Except for such items as livers, sweetbreads, and oxtails, frozen retail cuts of meat did not appear on the market in any significant quantity until the early 1940's. They still do not represent a very large part of the total retail sales of meats.

However, the situation is different in the locker plant phase of frozen food distribution. Here meats have served as the "backbone" of the industry. They are the products around which the locker plants are built. It is also true that meats are a very important item in the farm freezer. This would indicate that consumer acceptance of packaged frozen meats is not the major obstacle in the advancement of this phase of the frozen food industry.

On the other hand, it seems quite plausible that an increased use of frozen meats in the home could have a decided effect in bringing about greater consumption of other frozen foods. For one thing it would make possible fuller and thus more economical use of the home freezer.

Eggs.--Eggs were one of the first commodities frozen for commercial use. Oddly enough, the freezing of this product which has assumed such importance today, started as a salvage operation for those eggs which even though their interior quality was good, could not be marketed in fresh form because of cracks, soiled shells, and sizes too small to be in demand. It was found that such eggs could be frozen during the time of the year when they are in heavy production and stored for later use by prepared-food

^{2/} Poultry Inspection Section, Inspection and Grading Division, Dairy Branch, Production and Marketing Administration, U. S. Dept. of Agr.

industries, such as bakers, ice cream manufacturers, and preservers. However, it was not long before the market for frozen eggs took on an importance all its own, for in many instances they proved to be more desirable than the shell eggs for the manufacturers of prepared foods. There are several reasons for this: The food manufacturer does not have to invest in facilities for breaking; there is less chance of loss from unusable eggs; and frozen eggs can be purchased in the form needed, such as whole eggs, yolks, and albumen.

The bulk of the frozen egg pack is produced from eggs which cannot be profitably marketed in other forms, and from eggs procured during seasons when the market is saturated and prices are low. Production of frozen eggs has been decidedly on the increase for the past 20 years. In 1927, 34 million pounds, in 1938, 116 million pounds, and in 1947, 371 million pounds of eggs were frozen. This pack is almost entirely for industrial use. Some frozen eggs are used for the larger hotels and institutions, but the smaller eating establishments and the homes do not use them because of limited requirements for cooking purposes.

Fishery products.--Fish and shellfish are among the most perishable of all food items. They have been preserved by drying, salting, and smoking since prehistoric times. Canning began early in the nineteenth century and developed quite rapidly into an important industry. Although each of these methods served well to preserve the food value of the fish, the flavor and appearance were changed. The year 1918 marked the beginning of the quick-freezing of fish in the United States, which was more than a decade before this process was applied to other foods. The Otteson freezer, named after its inventor, was shipped in from Denmark at that time and was experimented with by the United States Bureau of Fisheries. Haddock fillets and, to a lesser extent, steak cuts were the first of the quick-frozen foods to be sold in small prepackaged form.

In 1948, 41 percent of the fish that was frozen was packaged as fillets and steaks, fillets accounting for the greater share. Six items accounted for 55 percent of the total fishery products frozen. In the order of poundage they were: Rosefish fillets, halibut, shrimp, mackerel, haddock, and headed and gutted whiting. 3/

The landing and freezing of fish are quite seasonable in nature. March through October covers the heaviest landings for most species. Halibut is frozen during May, June, and part of July, while cod fillets, rosefish fillets, and shrimp are frozen throughout the year but in greater quantities during the summer months.

Cooked and other specialty foods.--The group commonly referred to as cooked and other specialty foods includes many items, such as cooked "dishes," uncooked rolls and pastries, and even whole cooked meals. During the early 1940's some people thought that these prepared foods would soon become the backbone of the frozen-food industry. Although their views may have been overemphasized, this phase is continually growing in importance.

Table 8.--Frozen fruit: United States pack, by regions and commodities, 1947

Commodity	North-east	South	Midwest	West	Total
	1,000 lbs.	1,000 lbs.	1,000 lbs.	1,000 lbs.	1,000 lbs.
Apples	13,133	1,892	7,189	6,187	28,401
Apricots	--	--	--	6,007	6,007
Blackberries	155	1,335	214	12,806	14,510
Blueberries	2,201	173	2,887	146	5,407
Boysenberries	27	1,233	1/ --	11,235	12,495
Cherries, red, sour	18,659	2/ --	39,759	8,584	67,002
Currants	2,198	--	558	1,334	4,090
Gooseberries	--	--	1/ --	93	93
Loganberries	--	--	--	2,299	2,299
Orange juice, single strength, equiv.	--	3/ 17,000	--	3/ 3,000	20,000
Peaches	1,954	8,462	810	15,808	27,034
Raspberries, black	1,709	267	2,134	3,006	7,116
Raspberries, red	1,294	101	869	23,137	25,401
Strawberries	10,548	25,861	9,700	62,927	109,036
Youngberries	--	--	--	1,161	1,161
Miscellaneous fruits	8,657	3/ 1,000	9,080	21,165	39,902
Total	60,535	57,324	73,200	178,895	4/ 369,954

1/ Included in West production.

2/ Included in Northeast production.

3/ Estimated.

4/ Adjusted for orange juice single strength equivalent.

Source: Figures from the National Association of Frozen Food Packers unless otherwise indicated.

Dairy products.--Ice cream is, of course, the best known of frozen dairy products and perhaps even the best known of the frozen foods, though frequently it is not associated as being part of the industry. This is largely because the ice cream industry was widely established prior to the advent of other frozen foods.

Another frozen dairy product is fluid or plastic cream. Although it is frozen chiefly for the purpose of storing during surplus seasons, frozen cream has advantages of convenience in industrial use.

Table 9.--Frozen vegetables: United States pack, by commodities and regions, 1947

Commodity	East and South	Midwest	West	Total
	1,000 lbs.	1,000 lbs.	1,000 lbs.	1,000 lbs.
Asparagus	4,288	243	6,206	10,737
Beans, green & wax	16,880	755	13,276	30,911
Beans, lima	29,327	1,351	36,899	67,577
Broccoli	1,876	--	8,738	10,614
Brussel sprouts	<u>1/</u> --	--	3,299	3,299
Carrots	--	381	2,524	2,905
Cauliflower	206	<u>2/</u> --	4,625	4,831
Corn, cut & on-cob	5,665	4,609	22,349	32,623
Peas	22,726	16,466	92,594	131,786
Peas & carrots	<u>3/</u> --	1,690	3,611	5,301
Rhubarb	236	337	924	1,497
Spinach	15,701	<u>2/</u> --	7,578	23,279
Squash & pumpkin	461	1,506	3,223	5,190
Succotash	926	2,193	644	3,763
Other vegetables	4,379	2,622	3,953	10,954
Total	102,671	32,153	210,443	345,267

1/ Included in West production.

2/ Included in East and South production.

3/ Included in Midwest production.

Source: National Association of Frozen Food Packers.

Where Frozen Foods Are Produced

An estimated 981 processing plants of all types are freezing foods in the United States and Alaska. Figure 2 shows that there is a heavy concentration of these plants in California, Oregon, Washington, New York, and Massachusetts. This is owing to the fact that in New York and the Pacific Coast States several of the kinds of foods commonly frozen are produced in quantity. The large number of plants in Massachusetts is mostly accounted for by the extensive fishing industry in that area.

Fruits.--Nearly three-fourths of all fruits frozen are packed in the West, principally California, Oregon, and Washington. Production of the

remaining one-fourth is divided about equally among the other sections of the country, namely, Northeast, South, and Midwest. The distribution of processing plants shows that 188 out of the total are located on the Pacific coast. (See fig. 3.) There are also some 68 fruit freezing plants in New York State where sizable quantities of apples and cherries are processed. Michigan has 26 plants engaged in fruit freezing. Cherries, apples, and berries are the principal products. In Louisiana and Tennessee, strawberries are frozen in volume. Peaches are frozen mainly in Georgia, Arkansas, California, and Tennessee. Table 8 shows frozen fruit packed in the United States in 1947, by regions.

Vegetables.--The number of plants freezing vegetables is considerably less than those freezing fruits. There are about 230 plants in the country engaged in vegetable freezing. (See fig. 4.) It should be pointed out that many of these plants freeze both fruits and vegetables. The production of frozen vegetables is also concentrated in a few areas, more than half of them being produced on the Pacific coast. New Jersey, Minnesota, and New York account for a large part of the remainder. Table 9 shows the frozen vegetables packed in the United States in 1947.

Poultry.--Poultry products, consisting of chickens, turkeys, and ducks, are processed for quick freezing in about 102 plants in the United States. (See fig. 5.) This does not take into account the numerous poultry-processing plants and refrigerated warehouses that slow-freeze New York dressed birds, which are thawed and further processed before being used by consumers. The areas of the United States that are the heaviest producers of live birds are also the sections where most of the eviscerating and freezing plants are located. The Midwestern States, from Arkansas north to Minnesota, have the heaviest concentration of plants. There are also numerous plants for freezing turkeys and other poultry in sections of California.

In recent years the Del-Mar-Va Peninsula of Delaware, Maryland, and Virginia, certain areas in Georgia, and the Shenandoah Valley of Virginia, have become prominent in the eviscerating and freezing of cut-up broilers. It is estimated that about one-half of the broilers produced in the United States comes from these States.

Poultry marketing specialists have predicted that most of the plants now equipped for freezing poultry will continue to increase their output. It is likely, also, when new processing plants are built in the areas of poultry production, that many of them will include facilities for eviscerating and freezing their products. The areas where turkeys and ducks are produced for freezing are fairly widespread. The leading turkey-producing States are California, Texas, and Minnesota. Ducks are produced principally in New York, Michigan, and Ohio.

Meats.--Unlike the other major commodities frozen, meats are not frozen in the producing areas. This is principally because the larger meat packers have not entered the quick-freezing business to any large extent. Most of the meat that is frozen is done by small specialized

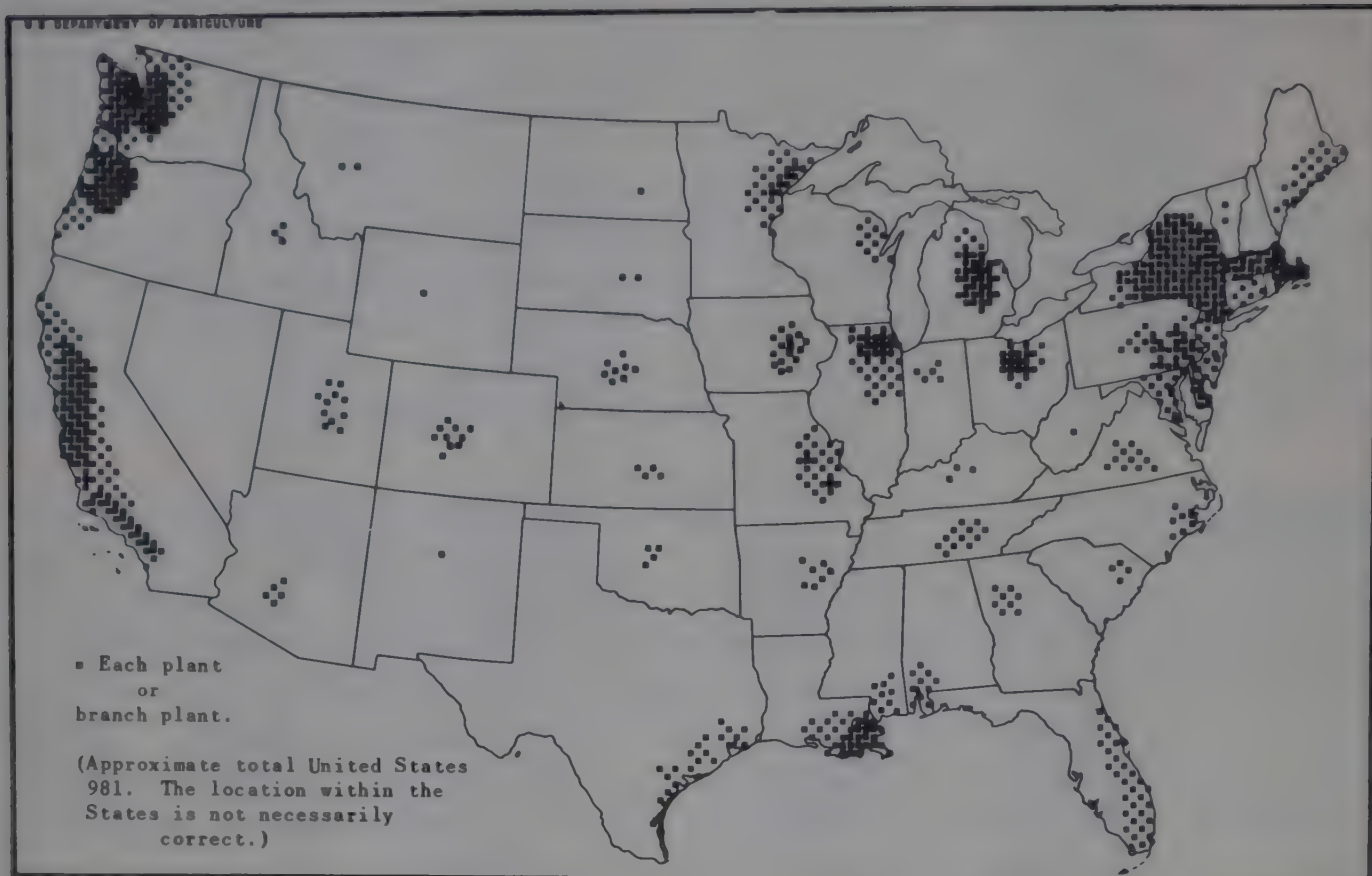


Figure 2.--Distribution of frozen food processing plants in the United States, 1948. (Many plants process and freeze several types of products)

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

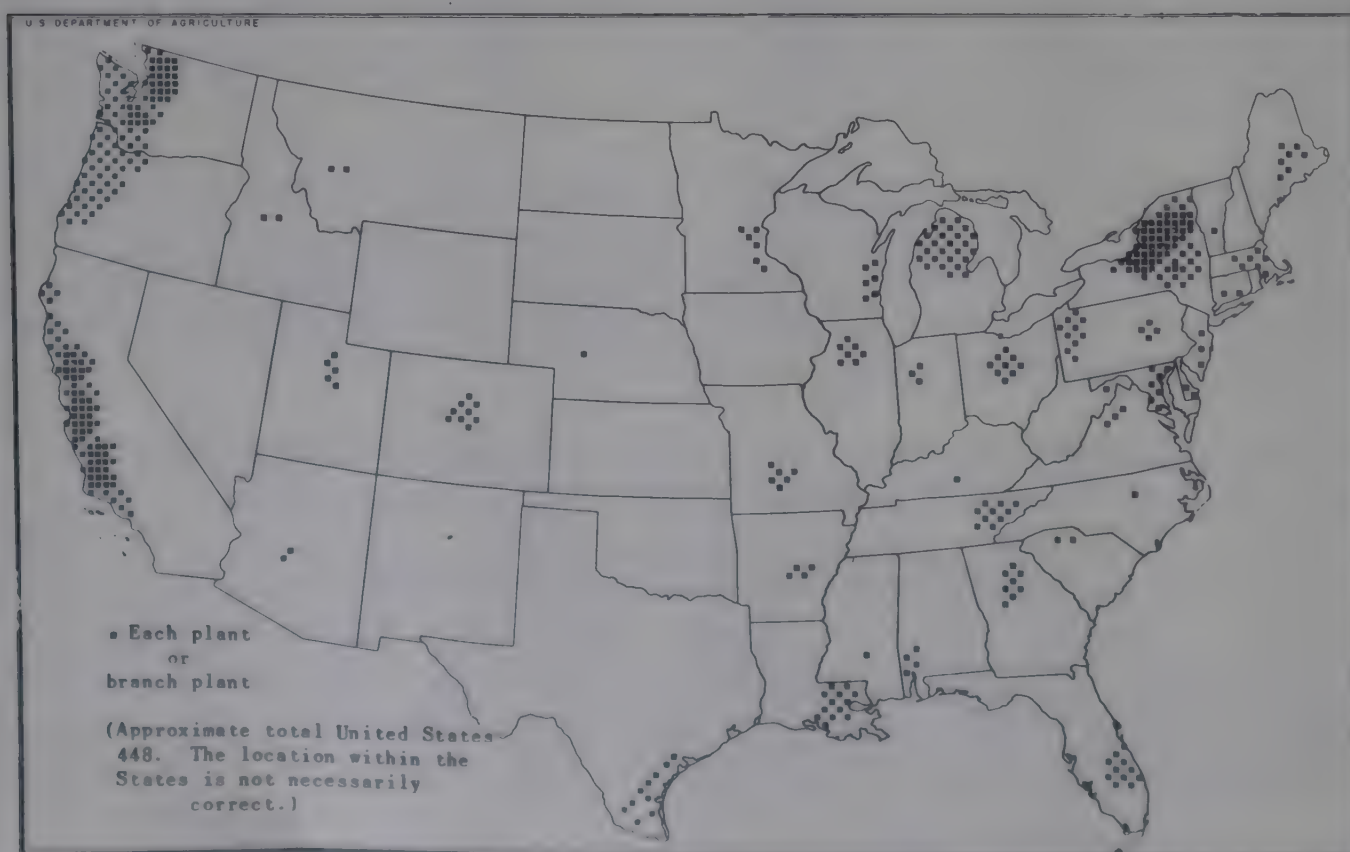


Figure 3.--Distribution of plants in the United States that process and freeze fruits and berries, 1948

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

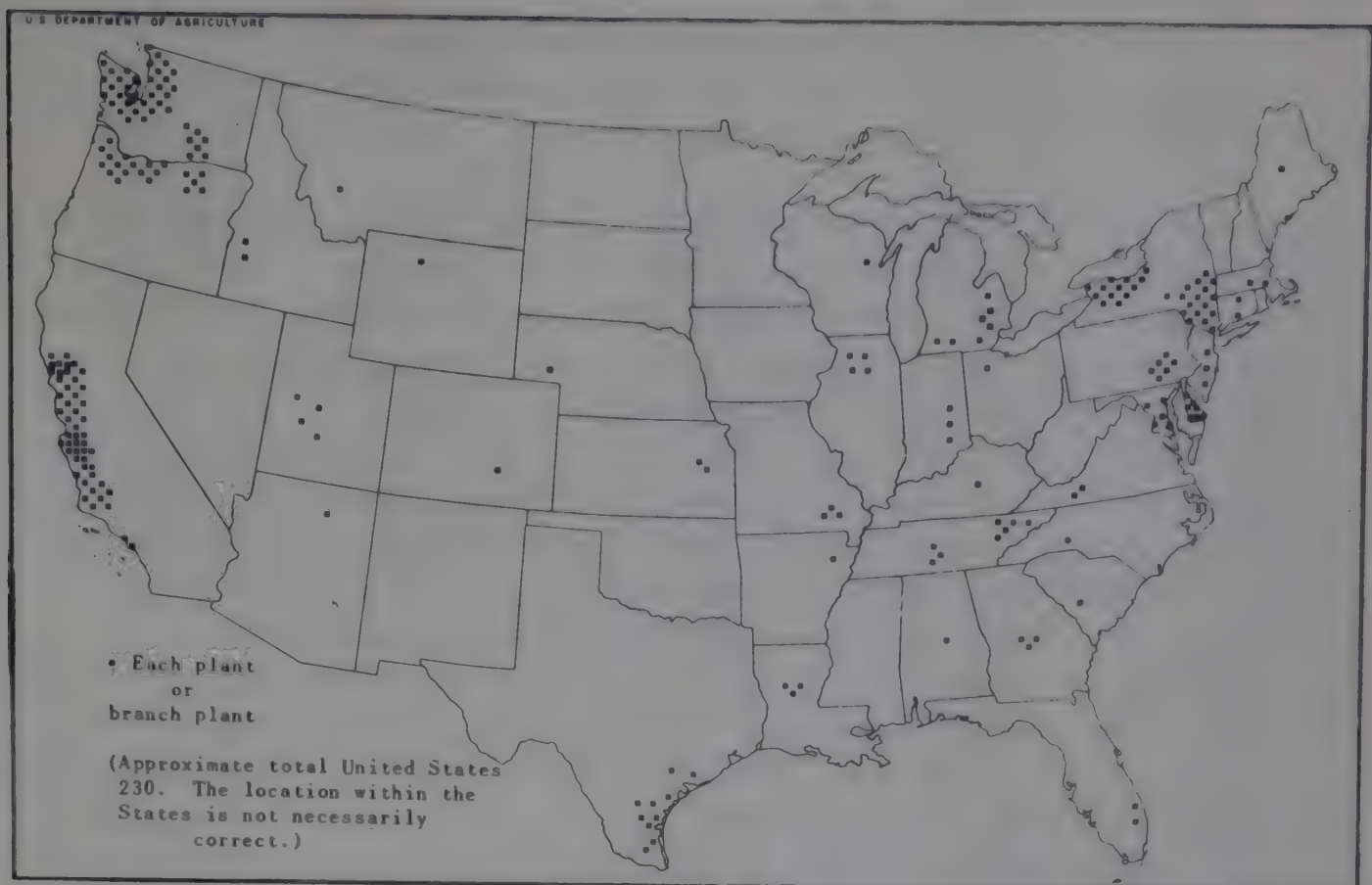


Figure 4.--Location of plants in the United States that process and freeze vegetables, 1948

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

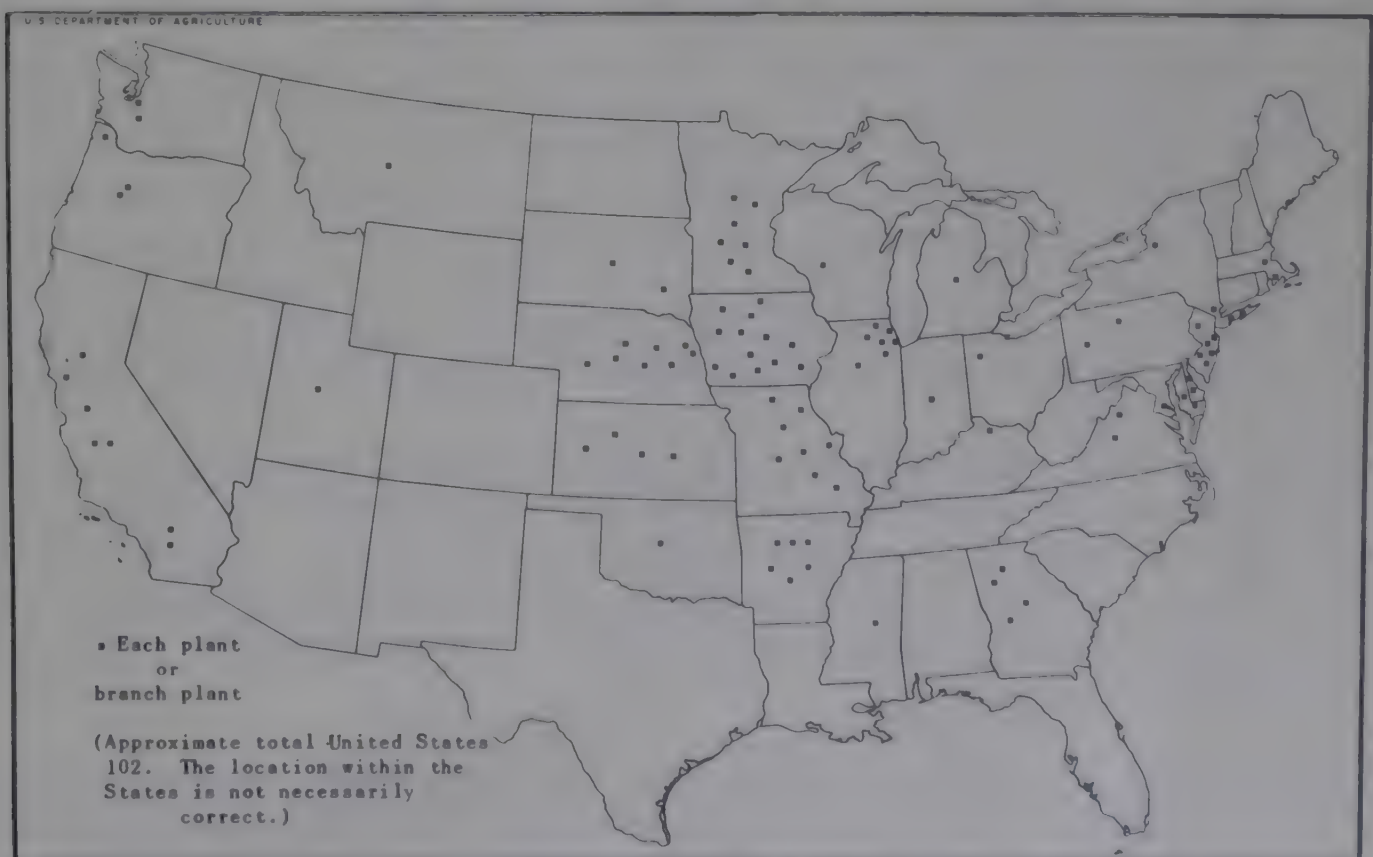


Figure 5.--Distribution of plants in the United States that process and freeze poultry, 1947

Source: Compiled from data furnished by the Poultry Branch and supplemented by unpublished data, Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. of Agr.

companies located in and around the big cities. This is illustrated in figure 6, which shows that the heaviest concentration of plants is in the vicinity of New York City, Boston, Chicago, Los Angeles, and San Francisco.

Eggs.--Many of the egg-breaking plants in the United States prepare eggs for freezing. However, some of these plants do not have their own equipment for freezing, but rather rely on a nearby refrigerated warehouse to do this job. As can be seen in figure 7, egg-breaking plants are located predominantly in the egg-producing areas of the Midwest. Some of them are operated for only short seasons and consequently have relatively small outputs. As previously pointed out, eggs were frozen commercially in large quantities before the freezing of other foods became important. Therefore, many of the egg-breaking plants that process eggs for freezing have been engaged in this occupation for 10, 20, or more years. Because of the predominant practice of breaking and freezing eggs in the areas where they are produced in abundance, it is not expected that the areas of egg freezing will shift unless new regions of egg production become established. There are several large cities in the country that are located outside of the principal egg-producing areas having a number of egg-breaking plants. In such cases the supply for freezing is usually drawn from local market undergrades or surpluses.

Fishery products.--The chief concentrations of freezing plants are along the New England and Middle Atlantic States coastline, the West coast, the Gulf coast, and around the Great Lakes region. (See fig. 8.) The freezing plants in the New England States feature frozen fillets of haddock, cod, rosefish, and frozen whiting. They also freeze mackerel, pollock, hake, herring, and squid in appreciable quantities. Mackerel, butterfish, weakfish (sea trout), croakers, and bluefish are frozen in significant quantities in the Middle Atlantic States. The West coast is becoming recognized for frozen salmon, sablefish (black cod), and halibut; while the south central region specializes in shellfish and other southern species. Lake trout, yellow perch, pike, and whitefish account for most of the Great Lakes frozen-fish industry. Imports from Canada, Alaska, Newfoundland, and Iceland have been made in recent years.

Technological developments in the freezing, handling, and distribution of fish are being stressed more and more as the fish industry bids for the vast potential consumer market in the inland regions of the United States. New and improved methods of cutting, freezing, packaging, storing, transporting, and retailing are constantly being adopted by the industry.

Cooked and specialty foods.--For the most part, cooked and specialty foods are prepared and processed in or near the large metropolitan areas. (See fig. 9.) More than three-fourths of the plants processing these products are located in about six big cities, and by far the larger part of their output is sold within the area where it is manufactured. Exceptions to this are found in the instance of a processor who sells most of his precooked meals to airlines for serving to passengers and in the case of a New Orleans company which ships seafood dishes prepared from special recipes to all parts of the country.

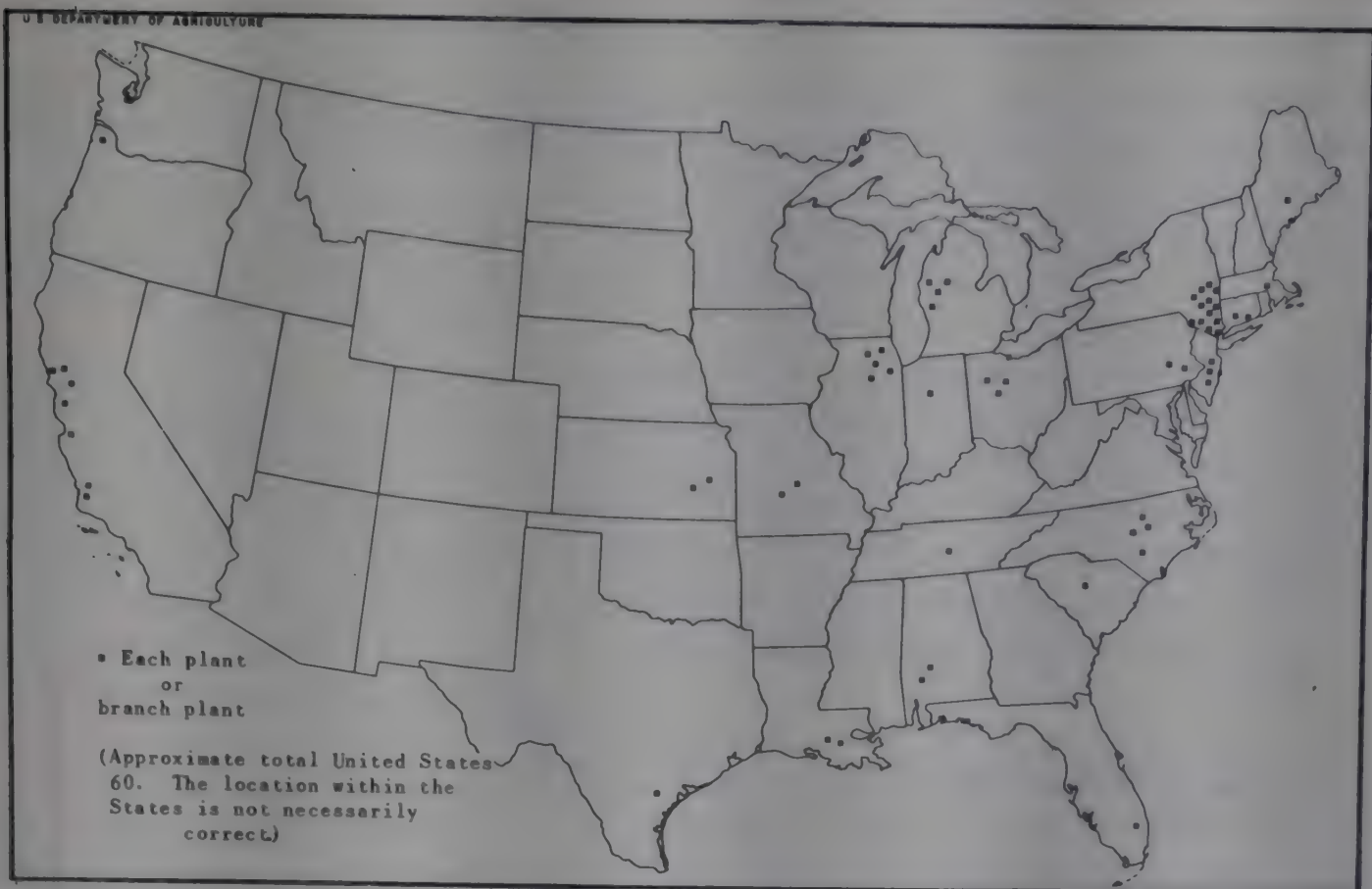


Figure 6.--Distribution of plants in the United States that process and freeze meat, 1948

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

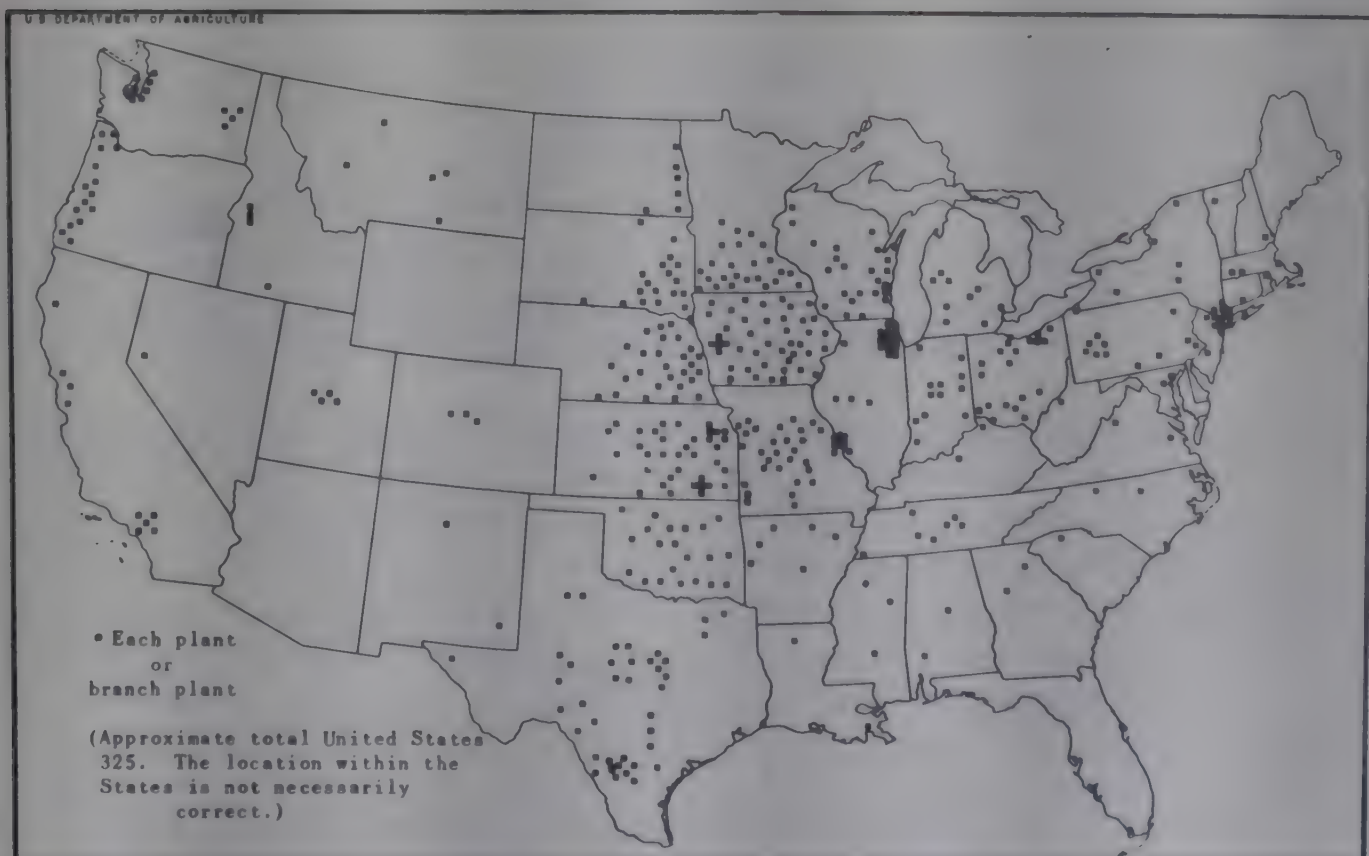


Figure 7.--Distribution of plants in the United States that break and process eggs for freezing, 1946

Source: Compiled from map of egg breaking and drying plants, Poultry Branch, Production and Marketing Administration, U.S. Dept. of Agr. .

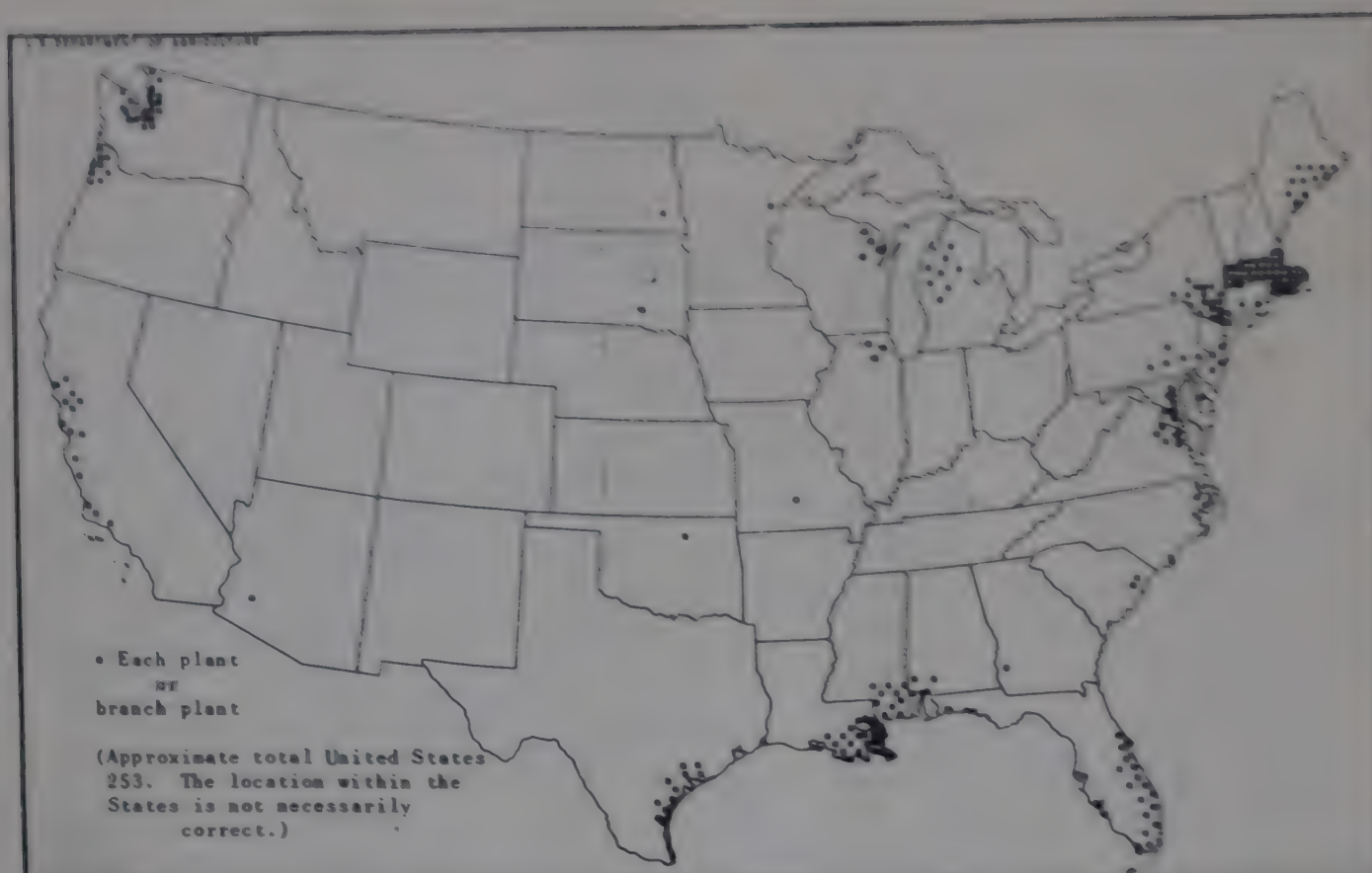


Figure 8.--Distribution of plants in the United States that process and freeze fishery products, 1948

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

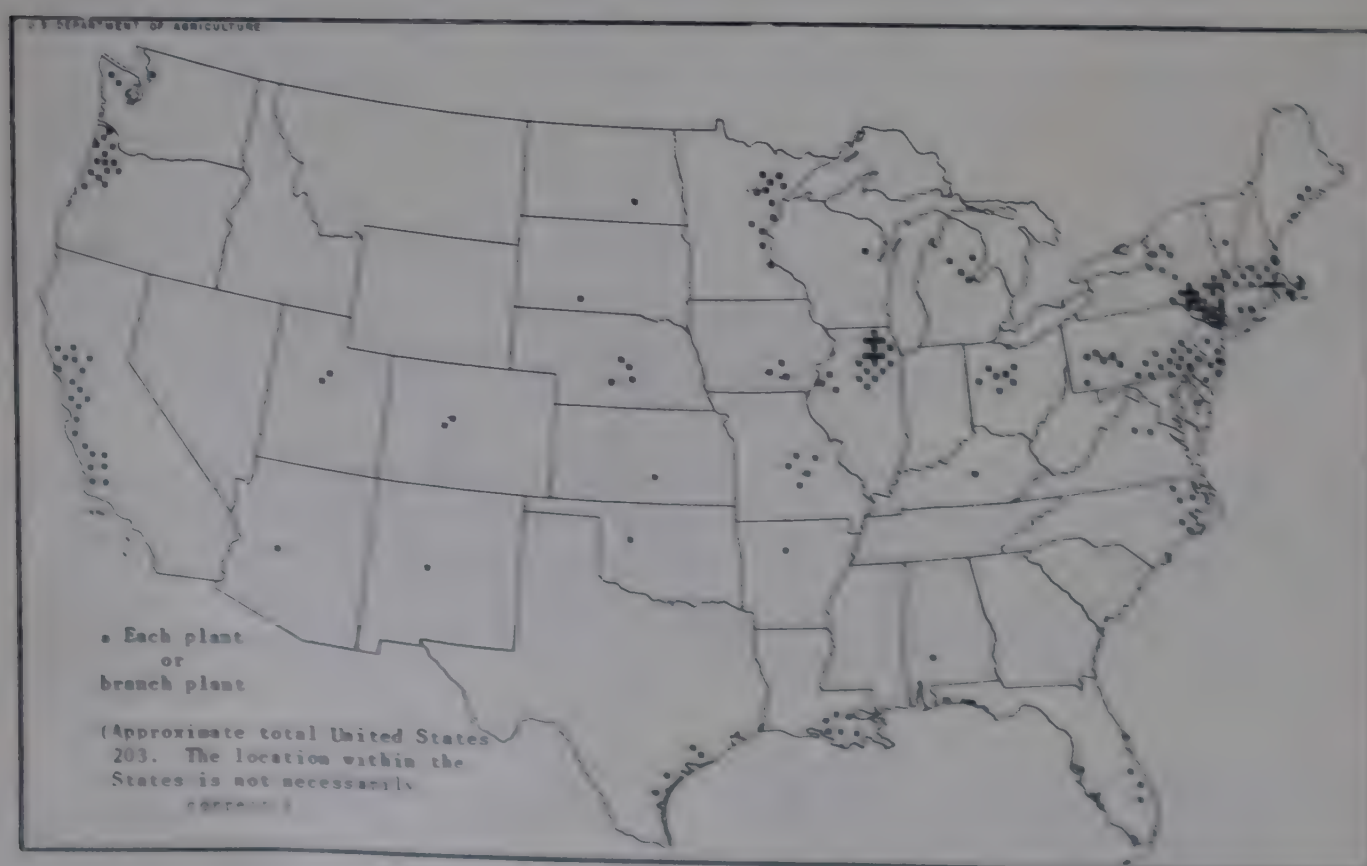


Figure 9.--Distribution of plants in the United States that process and freeze cooked and other specialty items, 1948

Source: Compiled from Directory of Packers, 1948, Quick Frozen Foods, and from unpublished data, U.S. Dept. of Agr.

Organization of the Industry

Packers and packer-distributors.--Although actual operations vary somewhat according to the product, the principal function of the packer, insofar as the physical handling is concerned, is that of cleaning, grading, freezing, and packaging frozen foods. He also provides initial storage for products prior to the time of shipment.

There are two principal systems used by packers for the disposition of their frozen packs. A large number prefer to sell their products to whomever will buy them. These concerns may pack under their own label or contract to pack under a customer's label. But in either case they exercise no control over the functions of distribution. They sell to wholesalers, large industrial users, retail chain stores, or to large organizations of independent retailers. Many depend on brokers to sell their products for them.

The other system of selling represents that followed by packer-distributors. There are several large packing organizations which generally obtain, process, and freeze their products in the same manner as other packers. But when it comes to selling their packs they also handle primary distribution; that is, these packer-distributors establish agency outlets for distribution, which may either cover a region or the entire country. Each of their agent wholesalers is assigned a district in which he distributes the products of the packer-distributor he represents. The packer-distributor packs most of his own products and sells under his own label. However, some also sell a part of their packs in the same manner as the regular packers.

Primary distributors.--These firms perform essentially the same function of distribution as the packer-distributors. The chief difference, however, is the source of their frozen products. Where the packer-distributor buys the raw commodities, packs, and freezes his own products, the primary distributor must arrange with packers to supply him with the frozen foods. A primary distributor buys on a contract basis that usually provides for the packages carrying his trademark or label.

Brokers.--The broker plays an important part in the distribution of frozen foods. His primary function is to serve as an agent in a trade area for one or more sellers or principals. He effects sales according to the terms of the seller, who in turn pays him a standard brokerage fee. The packer is usually the principal, and the wholesale distributor is usually the customer. However, in some cases the brokers sell the packers' products direct to large industrial and institutional users. The broker does not own or physically handle the products. Packers, packer-distributors, and primary distributors do not use broker service to any extent in areas where they have regular agent wholesalers.

The broker also aids his principal in finding adequate storage facilities needed in his market. In some cases he assists the wholesalers in promoting sales and in making good use of advertising. The frozen food

broker has played an important part in developing a greater market demand for frozen foods. Where he has served as a broker for other foods prior to taking on frozen products, he has been in a good position to introduce the frozen items to his regular customers.

The exact functions and services performed by the various brokers are determined by agreements between brokers and their respective principals. But those functions observed above are generally common to all frozen food brokers.

Wholesalers.--Wholesalers buy about 38 percent of their merchandise from packers, about 50 percent from packer-distributors, and 12 percent from primary distributors. Those who buy from packer-distributors or primary distributors usually serve as agents for handling the brands of their respective suppliers.

Industrial users.--Manufacturers of preserves and ice cream, as well as bakers of pies and other prepared foods, are representative of the industrial users of frozen foods. Many of these industrial users buy the frozen foods that are used as ingredients for their products from the wholesale distributors. However, numerous preservers and also other firms that use sizable quantities of frozen products frequently buy supplies direct from the packer, packer-distributor, or primary distributor.

Institutions.--Restaurants, hotels, clubs, hospitals, and retention homes are classified as institutional users of frozen foods. They buy their frozen merchandise from wholesalers and use it in preparing meals which they serve to their customers or patrons.

Retail grocery stores.--Retail stores, of course, obviously sell frozen foods direct to the final consumers. And most retailers buy their frozen products from local wholesalers. However, a few chain stores and organizations of independent retailers buy directly from packers, packer-distributors, and primary distributors. They have established central buying agencies for performing the wholesale distribution function usually performed by the conventional wholesaler.

Department stores.--The numerous department stores that are now engaged in selling frozen foods have different ways of functioning in this respect. Those that sell to retail customers at the store usually buy their frozen merchandise from the local wholesalers. However, several department stores also sell frozen foods to the consumers through home delivery service. These stores sometimes handle a sufficient volume to justify buying directly from packers.

Department stores that sell large quantities of frozen food are usually equipped with storage facilities that are suitable for handling carlot receipts of frozen foods. Rooms are also provided where frozen food orders are made up for delivering. Some department stores process and freeze prepared foods to complete their line of frozen merchandise.

Frozen-food specialty stores.--Very few retail stores sell frozen foods exclusively. However, the popular conception of a "frozen-food specialty store" includes those retail stores whose primary line of merchandise is frozen foods and whose secondary line includes a limited supply of grocery items, confectioneries, condiments, or picnic dishes. These stores usually buy their frozen food supplies from local wholesale distributors and sell direct to the final consumers. A few feature home-delivery service.

The frozen food section in department stores might also be considered as a frozen food specialty store in that it performs the same functions of retailing as do the independent specialty stores.

Home delivery.--There are a few firms whose primary function is that of delivering frozen foods directly to homes. But most of these firms providing the home-delivery service are also engaged in some other phase of the frozen food business. For instance, some department stores, grocery stores, and frozen food specialty stores deliver frozen foods to the home in addition to retailing them at the store. Even a few wholesalers have added home-delivery service to their frozen food operations.

Locker-plants.--Locker plants perform a wide variety of functions in the field of frozen food distribution. They process, wholesale, retail, and make home deliveries. Briefly, however, the following four functions are characteristic of many locker-plant activities:

- (1) Supply locker rental service.
- (2) Process and freeze raw products supplied by patrons.
- (3) Buy raw products from producers and process and sell them to consumers in either wholesale or retail quantities.
- (4) Buy from commercial frozen food packers and distributors and sell to consumers - frequently on a volume basis at a discount.

In the past, most locker patrons have been local producers who took their raw products to the locker plant for processing and storing in private lockers. But the recent growth in the number of city customers has caused locker operators to enter into the commercial sales of frozen foods.

Facilities Used in the Distribution of Frozen Foods

The fact that frozen foods require a low and constant temperature is self-evident of the need for properly refrigerated facilities through the marketing channel. The facilities through which the frozen foods pass on their way from the freezing plant to the ultimate consumer can be broadly classified as warehouses, rail cars, trucks, wholesale stores, cabinets of retailers and institutions, industrial store units, locker plants, and home freezers. However, in tracing the ordinary movement of frozen foods through the channel of distribution the facilities cannot be so easily and concisely defined. Figure 10 shows by diagram the types of facilities commonly used. Each of the facilities involved is discussed in subsequent chapters.

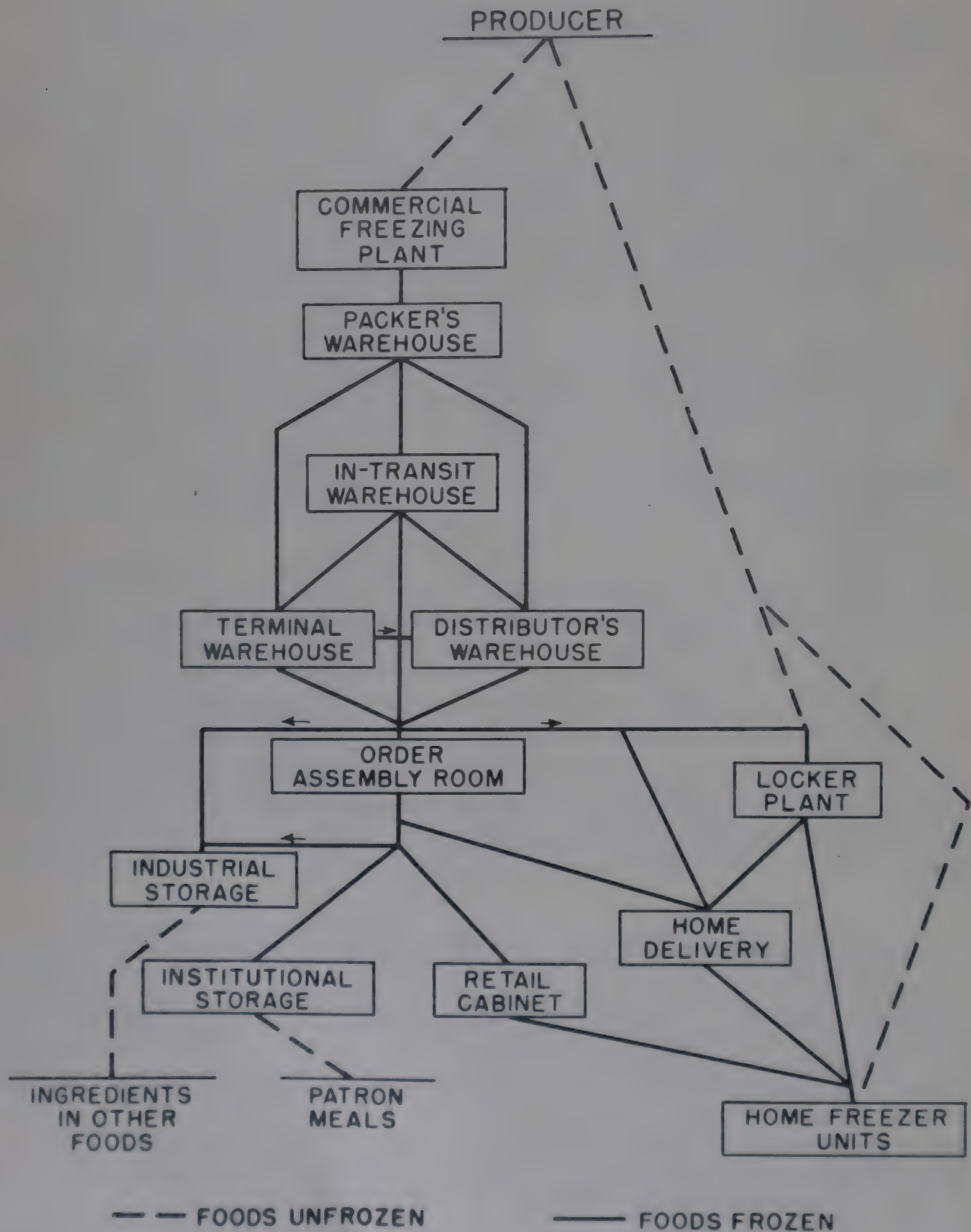


Figure 10.--Facilities used in distributing frozen foods. Lines and arrows indicate the movement of the products from producer to consumer.

THE PROCESSOR'S ROLE IN MARKETING FROZEN FOODS

In considering the distribution of frozen foods it is only natural that the processor's role in marketing be examined first. As previously pointed out, all the marketing operations are governed by the necessity of retaining the original "freshness" of the product. At the processing end it is necessary to take the first steps to prevent loss of nutritional value, flavor, color, and texture of the product to be frozen. It must be emphasized that insofar as fruits or vegetables are concerned, the selection of suitable varieties and the harvesting of these varieties at the peak of maturity are primary essentials in the production of a good frozen food. It is also important that packers use the best practices of grading, cleaning, blanching, freezing, and wrapping. Likewise, the treatment which meats, poultry, fish, and other foods receive before freezing determines to a great extent their marketing success.

It is also necessary to provide a high standard of sanitation in plants to keep bacterial counts low in the frozen food. The freezing operation does not carry with it the insurance against harmful organisms that high-temperature cooking in the canning industry provides. Therefore, there is a need for special caution as to sanitation.

Although fruits, vegetables, poultry, meats, fish, and cooked foods are handled in the same facilities when sold at wholesale and retail, they are processed separately and by somewhat different methods and equipment. In some cases, however, several types of frozen foods, such as fruits, vegetables, and poultry, are processed in the same general packing plant on separate "lines," and frozen in the same facilities. Although the processing techniques and equipment are different in many respects for each product after harvesting, the sequence will follow these general steps: (1) Cleaning; (2) special preparation for freezing; (3) wrapping, packaging, and freezing; and (4) storage prior to distribution. In the case of livestock and poultry, slaughtering and killing may be done at the processing plant.

Frozen Fruits and Vegetables

Farm production.--The first two steps in the production of fruits and vegetables for freezing are the selection of proper land and the planting of the proper seeds for the best freezing varieties suited to that land. Soil scientists have found that the growing of vegetables on certain types of soils in special instances affects the nutritional value of the product. The varieties of fruits and vegetables best suited for the fresh market and for the canning trade are not necessarily the best varieties for freezing. In any event, it is advisable for the processor to familiarize himself with the best freezing varieties that can be grown in the locality of his plant.

Location of plants.--By far, most of the processing plants are located in the immediate areas where the fruits or vegetables are grown, as shown in figure 11. However, some plants are located at or near



Figure 11.--Aerial view of several frozen-food processing plants and a refrigerated warehouse located in a producing area. W = refrigerated warehouse; F & V = fruit and vegetable processing plants; P = poultry processing plant.

terminal and assembly market points and receive their supply from products coming onto those markets. Usually the products are bought in competition with buyers for the fresh market. Also, there are a few packers who are located in the consuming areas, close to prospective purchasers of the frozen foods, and who import most of their products from various growing areas. Some products are bought direct from producers while other items are procured from firms in the fresh-marketing channel. Locating the processing plant in the area of principal distribution has the merit of allowing the packer a wide range of producing areas from which to choose his raw material. For example, he can have peaches shipped in from the area in which peaches for freezing can be best produced and spinach from an area where freezing varieties are at their best. However, such a packer is too far away from the producer to exercise much control over the production and harvesting of the product. This factor, together with those of transportation costs, shrinkage, and loss of nutritive value of the fresh foods during shipment, seldom justify such a procedure.

In determining the location for a plant, the processor should strive to locate his facility so as to obtain the most desirable combination of factors as follows: (1) Nearness to source of supply, (2) most advantageous prices for raw material, (3) nearness to market, (4) low capital costs for construction, and (5) low operating costs with respect to labor, power, and transportation.

Purchasing methods.--There are several methods by which processors purchase their fruits and vegetables for freezing. Probably the most common method, as carried over from the canning industry, is to purchase directly from the independent growers. On the other hand, the method of contracting with the local growers for a certain amount and a certain variety of product is gaining favor in many sections of the country. There are several variations of this procedure. As previously pointed out, in some cases the processor supplies the seed, advises as to the particular tracts of land that are best suited for their growth, and encourages the producer to employ the best cultivating practices. In other instances, supervision is less significant. Because of the importance of quality in frozen fruits and vegetables, it seems that close supervision in producing and harvesting the product has much merit.

Many packers of frozen foods are also producers of the raw product. In some cases the processor is an independent grower; in others, he is one of a number of growers who process their products cooperatively. The usual procedure is for growers to become processors; however, in some instances the reverse is true - some firms originally established as processors have also become farmers.

Since the canning of foods is frequently complementary to freezing, many processors who freeze foods are also engaged in canning. In some plants food freezing is the main function and in other plants canning is most important. Regardless of which is foremost in a plant, the two operations are mutually beneficial. When raw products that are not suitable for freezing come into such a plant, they can be easily diverted to the canning operation.

Preparation for freezing.--The plant processing and the harvesting operations are frequently overlapping. For example, the vining and shelling of peas and the husking of corn may be considered as part of the harvesting operation or as part of processing. The extent of the processing operation varies with the particular product. The preparation of vegetables for freezing usually involves the following operations: (1) Removing undesirable parts, such as pods, vines, and stems (fig. 12); (2) washing; (3) cutting or slicing; (4) grading for size and maturity; (5) inspecting - where undesirable parts are removed by further sorting; (6) blanching; (7) cooling; and (8) conveying to machines for packaging or freezing. Although all of the above operations are important in food freezing, the steps most likely to influence the nature of the final product are blanching and cooling. Tressler and Evers, commenting on blanching, have this to say: "The heating of the vegetable in steam or hot water, commonly called blanching, will, when properly conducted, inactivate the catalase and other enzymes which would

otherwise cause the development of off flavors and losses of color and vitamins C and A during cold storage. Moreover, it fixes the characteristic color of the vegetable." ^{4/} After the vegetables are removed from the blanch, they should be quickly cooled. This cooling is usually accomplished by dipping in or spraying with cold water. Cleaning and processing operations are usually performed while the product proceeds on an endless conveyor. After the vegetables have been cooled, they are moved into position for packaging and freezing.



Figure 12.--Close inspection is an essential step in the processing of foods prior to freezing. After being washed these cherries pass along the endless belt conveyor between rows of women who sort out the bad fruit.

The general procedure in the preparation of fruits is about the same as for vegetables, except steps 6 and 7 (blanching and cooling), as listed above, are omitted. Instead of the blanching and cooling operations, fruits are packed in sugar or sugar sirup, with or without the addition of some acidic antibrowning compound. As an example of

^{4/} Tressler, Donald K., and Evers, Clifford F., The Freezing Preservation of Foods, Avi Publishing Company, 1947, pp. 263-4.

processing, peaches have to be peeled, the stones have to be removed, and in the case of sliced peaches, the halves must be sliced before they are packed in containers and the product covered with sugar or sugar sirup. The packing of red sour pitted cherries involves washing, pitting, and packing into containers with dry sugar.

Packaging.--The packaging of fruits and vegetables does not always precede the freezing operation. In some freezing methods the product is frozen before it is packaged (fig. 13). The type of package is determined by the use to which the product is going to be put, that is, consumer or institutional. Fruits and vegetables going into the retail trade are packed in containers suitable for consumer use. These consumer packages usually are designed to hold a net weight of from 10 ounces to 1 pound, and are of many different sizes and shapes. Generally the structures consist of a sealed inner lining in a treated cardboard box, usually with a sealed overwrap. It seems, however, that the trend is toward the use of a one-piece laminated box that can be filled and closed with a minimum of hand operation. One of the chief handicaps of the industry in the past has been the slowness of the packaging operation. But designers of packages and packaging machinery are making considerable progress in surmounting some of the original handicaps. There is yet much room for improvement, however, before satisfactory efficiency is obtained.

When fruits and vegetables are packed for institutional use, larger containers are used than when they are destined for the retail trade. Most vegetables for the institutional trades are packed in containers similar in design and construction to those for retailing. The only difference is that the institutional containers are larger, generally with a capacity of from 2 to 10 pounds. A few vegetables are packed in cylindrical containers of the 30- to 50-pound sizes.

Fruits going to institutions are generally packed in tin or cardboard containers, holding 10, 20, 30, 40, and 50 pounds, with the 30-, and 50-pound sizes being the most predominant. These have friction-top lids and the tin cans are lacquer-lined. The filling machinery used is fairly simple in structure, and the lids are placed on the can by hand.

Fruits going to industrial concerns, such as preservers, ice cream manufacturers, or bakeries, are likewise packed in large containers with



Figure 13.--At the end of the processing line fruits and vegetables are frequently weighed and packaged before being frozen.

friction-top lids. The three most common sizes are containers that hold 30, 40, and 50 pounds. Also, some fruits are packed in medium- and large-size barrels for industrial use.

Freezing and storing.--The systems most commonly used for the freezing of fruits and vegetables are air-blast, indirect contact, direct immersion, and in some cases, still air. The innovations of progress, however, have brought about the use of other systems, such as the currently developed "vacuum-freeze."

In the air-blast system the product is placed in a wind tunnel or room where the air is circulated with great velocity (fig. 14). The temperature in the tunnel is usually down to -20° to -40° F. The two variations in the use of this system are: (1) To pass the unpacked commodities through the tunnel on a continuous conveyor or (2) to put the commodities already packaged or partially packaged on portable rack trucks where they remain stationary in the tunnel. In the indirect system, the product, usually in the container, is placed in contact with coils or plates within which a refrigerant flows. In the direct immersion system, the product is put directly into a refrigerant, such as a brine or sugar solution.



Figure 14.--Food is often frozen by placing stacks of packages in a tunnel where the temperature is held at 20° to 40° below zero F. Here a stack of freezing trays is being conveyed into one of several freezing tunnels.

The still-air type of refrigeration is merely a room held at 0° F. or below without air circulation. This system was used extensively several years ago for freezing "cold pack" fruits. In the last few years, however, fans have been placed in many of these "still air" freezing rooms, and the result has been a modified version of air blast. Some research workers have pointed out that the temperature of the fresh product should be lowered quickly through the first 10° to 15° of freezing, that is, from 32° to about 20° F., in order to minimize cell destruction. As far as fruits and vegetables are concerned, this has reduced the importance of still-air freezing.

Most of the large packers of fruits and vegetables have their own freezing facilities at the processing plant. However, there are some packers who rely on a local public warehouse to perform the freezing function. For example, strawberries already processed and packaged may be hauled from a packing plant to a nearby warehouse for quick-freezing and then conveyed direct to storage rooms. Since the freezing technique

is one of the most important keys to the whole system of preserving the original quality of the fresh fruit or vegetable, it is of paramount importance that not only the best facilities be used for doing the job but consideration be given to the proper location of the freezing equipment to the processing operation. Present thinking among research leaders is to encourage any arrangement of facilities that will shorten the time between the harvesting and the freezing of the product. In this respect it is important for a processor to gear his rate of processing to the rate that his equipment will freeze the products, so as to reduce time lag between the two operations.

After the commodity has been frozen, it is necessary to put it into a zero storage room for holding until shipped. There is considerable variation as to the length of time that packers hold frozen foods at their local storage facilities before shipping to other points for storage. This subject is discussed at length in a later chapter.

Frozen Poultry

Farm production.--The freezing of poultry depends on the farm production of the proper breeds and weights for the various available markets. This means the growing of different sizes and ages for frying, stewing, or roasting. In recent years there has been a trend toward specialization of production to the extent that many producers raise poultry definitely for meat purposes.

Location of plants.--It has become a common practice to process and freeze birds in the producing areas and ship them to consuming markets packaged and ready for use. However, there are many instances where midwestern processors receive broilers from other producing areas and eviscerate them for consumption in the Midwest. In any event, warehouse storage facilities adequate for taking care of peak production should be available in the area where the processing is done.

Killing, dressing, and eviscerating.--The time for killing poultry is important largely because of the age and weight factors. For example, chickens raised for the broiler market must be approximately 8 to 12 weeks old and must be slaughtered before the dressed weight (feathers and blood removed) exceeds $2\frac{1}{2}$ pounds, and chickens raised for the fryer market should be approximately 13 to 20 weeks old and not weigh over $3\frac{1}{2}$ pounds when dressed. Similarly, there are definite weight limits and approximate age limits for other young birds, such as roasters, stags, and capons. The chickens classified as old birds (fowl or stewing chickens and cocks) have no limiting age or weight factors. ^{5/} Turkey slaughtering is highly seasonal and is concentrated during the fall months at the close of the producing period.

^{5/} Tentative U.S. Standards for Classes and Grades for Dressed Chickens, U.S. Dept. Agr., Production and Marketing Administration, 1943. (Processed.)

The methods of killing vary from plant to plant, but the modern methods frequently involve the use of overhead conveyors, which provide a continuous operation from the point of slaughter. The remainder of this dressing operation includes such tasks as scalding, plucking, pinning, singeing, and washing (fig. 15). After being dressed, the birds are either eviscerated while still warm or they are removed from the conveyor and placed on cooling racks or in vats of ice water to reduce body temperature to about 36° F. When birds have been precooled, they are either packed as New York dressed and possibly frozen or further processed and quick-frozen. While poultry for roasting and stewing are usually packaged as whole birds, fryers are generally cut up and packaged before freezing (fig. 16).

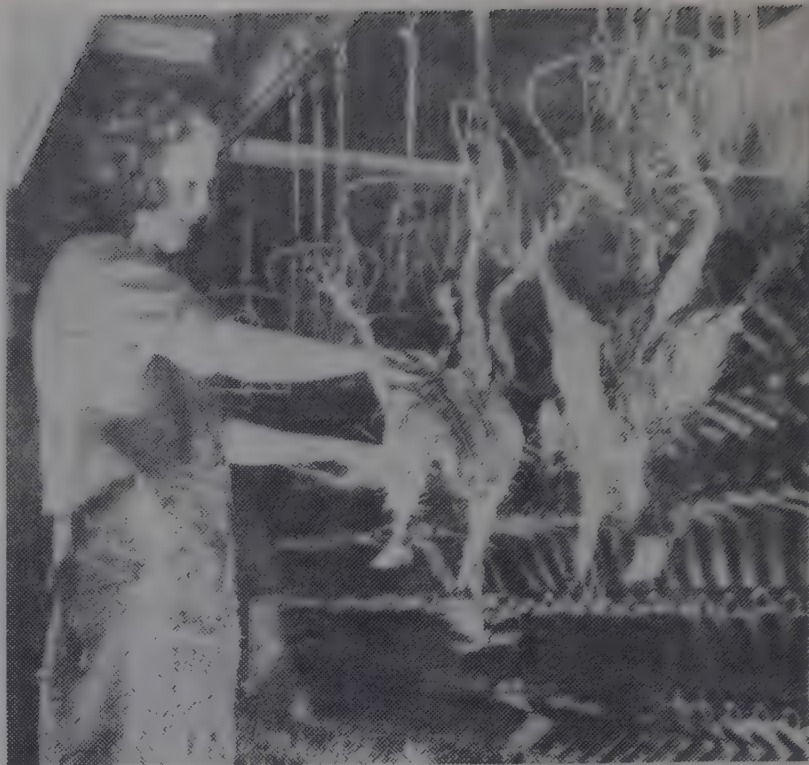


Figure 15.--The first part of the dressing operation is to remove the feathers from the chicken. Here a mechanical picker is being used for this purpose. Operator removes most of the remaining feathers by holding the bird against the revolving rubber fingers.



Figure 16.--After being eviscerated and otherwise cleaned whole birds are frequently cutup for packaging and freezing. Notice the use of a saw for expedient handling.

Packaging.--Whole eviscerated poultry is frequently packaged in a tight-fitting cellophane container, while cut-up birds are usually put into light paperboard boxes lined and wrapped with cellophane. Considerable quantities of chicken parts packaged similarly to cut-up birds are packed for retail and institutional sales. Regardless of the type of package used, the object is twofold: First, to have a durable package that affords maximum protection for the product, and, second, to present a package that suits the need of the customer to be reached, that is, a small one for the family consumer and a larger one for the institutional concern. Of course, the design of the package is tempered with the necessity for a certain amount of eye appeal.

Most packaging is done jointly by machine and hand, and the final treatment is to heat-seal the openings.

Freezing and storing.--The freezing of poultry is accomplished, for the most part, after the birds are packaged. Because the killing and plucking operations are much faster in most plants than the eviscerating operation, birds are sometimes held in ice vats or coolers for periods of time during the two operations. Likewise, small amounts are frozen in the New York dressed style for short holdings and are later thawed for eviscerating, packaging, and refreezing. It is generally believed to be most desirable, from the standpoint of product quality, to send the birds through the processing line from the killing pen to the freezing operation without undue loss of time.

The freezing equipment is about the same for poultry as for fruits and vegetables, except the still-air method is sometimes used for freezing New York dressed poultry. The air-blast method, as well as the indirect contact method, is commonly used for freezing eviscerated birds.

Although most poultry processing plants operate their own freezers, there are some plants that rely on the public warehouse to do the freezing. In such cases the poultry is taken directly from the processing line to the local warehouse freezing room. A few plants that are dependent on the warehouse for freezing are located within the warehouse building or adjacent to it.

It is necessary to put the packages in containers of "case" size before storing. Cartons of frozen cut-up poultry are usually packed in heavy cardboard cases, while whole eviscerated birds wrapped in cellophane are frequently packed in light wooden containers. New York dressed poultry is usually packed in light wooden cases before being put into the freezer for slow freezing.

The storing of birds after freezing is not just a matter of putting the boxes into a zero room, but careful attention has to be given to such factors as humidity, stacking, cleanliness of rooms, and the retarding of air circulation.

Frozen Meats

The methods of producing and slaughtering livestock for freezing, as currently practiced, are about the same as for the fresh meat market.

Location of plants.--Most of the meats sold in package form today are, contrary to popular belief, processed at the wholesale level in plants that are located in consuming areas. The large meat-packing plants located in the principal western producing areas have not as yet undertaken on a large scale the packaging and freezing of meats. Most of the non-slaughtering processors now freezing consumer cuts of meat buy in wholesale quantities from packers.

Preparation for freezing.--The difference in preparing meats for the fresh market and for the frozen market perhaps begins with the boning and retail cutting operations (fig. 17). All meat usually passes through the marketing channel in the whole carcass, halved carcass, or whole-sale-cut form. Fresh meat wholesalers seldom cut their products into consumer size pieces for the retail trade. Even in packaged unfrozen meats the cutting is ordinarily done at the retail store and the bones are not removed. Meat for freezing, of course, is boned during the cutting operation.



Figure 17.--The commercial processing of meats for freezing usually means the cutting and deboning of wholesale cuts into consumer-size portions. Note the scale for weighing individual cuts.

Packaging.--After the bone is removed and the consumer-size cuts have been made, the next step is packaging. The adequacy of the package is extremely important in conserving the quality of meat. This is true for the reason that frozen meat easily dehydrates and loses its flavor and color if exposed to air.

Woodroof, Atkinson, and Shelor ^{6/} have this to say about wrapping materials for frozen meats and chickens: "When selecting materials for the packaging of products for freezing storage there are several requirements and certain qualities that are agreed upon by many investigators which the wrappers must possess. Among the most important are, that the material must be moisture-vapor-proof, grease-proof, odorless and tasteless, non-toxic, strong enough to withstand handling, attractive, easy to apply, easy to remove, and flexible enough to adhere closely to the product. It must protect the product from the absorption of odors and flavors, protect the product from loss of odors, flavors, and colors, and the coating must not become brittle, crack, or peel when bent at low temperature."

Freezing and storing.--Both the air-blast and the indirect-contact methods are used extensively to freeze most meats. Sometimes the

^{6/} Woodroof, J. G., Atkinson, Ida, and Shelor, Ethyl, "Wrapping Materials for Frozen Meats and Chickens," Food Freezing, March 1947, p. 274, published with the approval of the Director of the Georgia Expt. Sta. as technical paper 167, Journal Series, Georgia Expt. Station and TVA cooperating.

air-blast method only amounts to a freezer room held at temperatures below zero, with some kind of modified air circulation. After freezing the packages are "cased" and put into zero rooms for storage.

Frozen Eggs

There are three important requirements of eggs destined for freezing. They must be large enough to make the breaking operation economical, eggs of good quality must be available in order to obtain high yields, and the shells must be clean enough to prevent contamination of the egg meats. It costs just as much to break a small egg as it does a large one. Also, it costs as much, or more, to break a rotten egg as it does one of good quality. A dirty egg necessitates extra effort in cleaning and increases the possibility of contamination.

Location of plants.--Although large quantities of eggs are being processed and frozen in the consuming areas, by far most of the freezing is done in areas where the eggs are produced. For best results plants are located at points where they can get a large and continuous supply of quality eggs during the breaking season.

Preparation for freezing.--Generally the eggs for freezing are separated from eggs intended for the fresh market at the time they are initially candled. Upon receipt of eggs at the freezing plants, they either are processed immediately or go into cooler storage until such time as they can be used. Usually the first step in processing is to candle and inspect the eggs for cleanliness, putting the dirty ones aside for washing prior to breaking. Care must be exercised in washing since the dirty water might penetrate the egg shell and cause contamination.

Although many breaking plants start processing eggs upon receipt at the plant or only after a short stay in a cold-storage room, it is generally considered best to allow the eggs to remain in a refrigerated room held constantly at 32° F. for about 3 days in order to allow the contents of the eggs to come down to that temperature. Eggs started out through the processing line at this temperature are likely to go into a freezer at a relatively low temperature and thus speed the freezing process, which in turn helps the quality of the egg.



Figure 18.--In the breaking room of the egg-freezing plant, operators quickly crack each egg on a breaking bar and drop the contents into a cup.

Eggs are broken by hand over a knife designed for that purpose (fig. 18), and the meats are put into cups--about three eggs to the cup. Before emptying the cups into a can the contents are observed for off-color and are smelled for off odors. Care must be taken in breaking to prevent any foreign material, and especially particles of egg shells, from getting into the egg meats. Before the egg-meats are dumped into the churn (fig. 19), they are again checked by a skilled inspector for off odors and off colors. Once in the churn the eggs are thoroughly mixed without beating any air into the mass. The eggs are put into the churn according to the end product desired, that is, whole eggs, yolks only, or whites only. When egg yolks are mixed, it is desirable to add a mixing agent to prevent the final product from being gummy. The most common agents used for this purpose are salt, sugar, other sweetening agents, and glycerine. The particular agent used is determined by the use to which the eggs are to be put. For example, the bakery trade prefers the use of



Figure 19.--An operator pours the egg meats from the cans into churns, which homogenize whites and yolks before the eggs are frozen.

sugar, and the manufacturers of mayonnaise prefer the use of salt. Special devices, either as part of the mixer or as a separate piece of equipment, are used to remove the shell fragments from the mass of egg meats.



Figure 20.--The homogenized liquid egg is run into large cans to be frozen and held for later use.

Packaging.--Upon removal from the churn, the eggs are put into tin cans, the most common size holding 30 pounds (fig. 20). These cans are then stacked in the freezing room.

Freezing and storing.--Until recent years it has been the practice of most processors to freeze eggs in rooms of 0° F. with normal air circulation. The freezing time under such conditions is about 72 hours. The use of quick-freezing methods

is coming into common use, however. Of these systems, the air-blast is most commonly used and by its use the freezing time is reduced by about one-half. The faster the freezing operation the less chance there is for the contents to sour. Since eggs sour very easily, meats in the center of a can will develop off-flavors if the freezing operation is too slow. For best results the eggs are stacked for freezing with enough room between the cans for free air circulation. After the eggs have been frozen solid, the cans are restacked in close stacks in a room held at or slightly below 0° F. until shipped out for storage elsewhere or until shipped to users or distributors.

Frozen Fish Products

Location of plants.--Plants for freezing fish are, naturally, located near bodies of water where fishing is done on a large commercial scale. The areas of most importance are found in New England, along the Great Lakes, along the Gulf coast, in the Pacific Northwest, and Alaska. It is very important that fish be frozen shortly after they are caught. Consequently some fishing boats are virtually floating freezing plants. Other boats, especially those that stay away from shore for more than 1 day, pack the fish in ice.



Figure 21.--Freshly caught fish are cut into fillets for packaging and quick-freezing.

Preparation for freezing.--Upon arrival at the fish-freezing plant, the fish go through a cleaning and dressing process. In the case of fin fish they are usually cut into fillets or steaks before freezing (fig. 21). Shellfish may be frozen in whole or as "meats." Fish to be held for later processing are frozen in "round" form, that is, without being cleaned or dressed.

Freezing, packaging, and storing.--The methods used for freezing fish are about the same as for other products. Both the air-blast and the indirect-contact methods are used extensively.

Fishery product containers are not standardized but the fillets and steaks are usually wrapped in moisture-vapor-proof material and packaged in paper cartons of from about 1- to 10-pound net weight sizes. Frozen shellfish, such as scallops, shrimp, and oysters, are frequently packed in cylindrical or rectangular containers, the type of container usually depending on the trade being served.

Obtaining the proper wrapping material has been, and still is, one of the technologists' greatest difficulties in the frozen-fish industry. Low storage temperatures quite effectively inactivate bacterial growths

and enzymes, but freezing alone cannot adequately control the oxidation of the oils or fats in the fish. ^{7/} The presence of oxygen causes discoloration, develops rancidity, and results in losing the fresh flavor of the fish. The Seattle Laboratory of the Fish and Wildlife Service in its experiments which are now in progress has demonstrated the inadequacy of ordinary moisture-vapor-proof films in keeping air away from frozen fish fillets and steaks. ^{8/}

Like other frozen foods packaged fishery products are put into larger containers of carton-size and stored at 0° F.

Other Frozen Foods

Cooked items.--Numerous precooked dishes, such as chicken á la king, boiled shrimp, lobster Newburg, Hungarian goulash, Irish stew, and even whole meals are being prepared in specially designed kitchens and sold through the regular frozen food channels. For the most part the raw product is procured in the same way as any other kitchen gets its supplies, and prepared in the initial steps as any other kitchen prepares food for serving. After preparation the foods are packaged in moisture-vapor-proof cartons or wrappers, frozen by one of the common methods - usually indirect-contact or air-blast, put into appropriate case containers and stored at 0° F. (fig. 23).

Other specialty items.--Uncooked but prepared specialty items have come into frozen food marketing channel in recent years. Like the cooked items these prepared foods are numerous, and typical of such foods are: Pies and other pastries ready for the oven, and various types of salads. These products are prepared for freezing in a special kitchen or bakery and after freezing are stored at 0° F. prior to shipping out to distributors.

^{7/} Lemon, J. M., Fish Refrigeration. Fishery Leaflet 214, Fish and Wildlife Service, U. S. Dept. Int. March 1947.

^{8/} Osterhand, Kathryn L., and Buchner, Doris L., Precooked Frozen Fish Preparations. Fishery Leaflet 144, Fish and Wildlife Service, U.S. Dept. Int. Sept. 1945.



Figure 22.--Laboratory control is an essential part of selecting and freezing any food product. Checks have to be continually made on such factors as maturity, flavor, and odor in order to assure a high quality food.

Dairy products.--Butter and cream frozen for holding purposes are usually processed in a regular dairy plant and frozen in air blast or still air in a refrigerated warehouse. Ice cream is processed and frozen by special equipment at the dairy plant.



Figure 23.--Steak meals are being partially cooked (top), put into disposable plates and packaged on an assembly line basis (middle), and then conveyed into a quick-freezing room (bottom).

TRANSPORTATION FACILITIES

Safe, low-cost transportation of frozen foods is one of the major problems facing the industry today. These problems are common to all frozen commodities. Although rail and truck facilities are constantly being improved most frozen foods are being transported long distances at temperatures considerably above 0° F. This condition, in many instances, causes damage to the quality of the product.

Rail Facilities

When the frozen food industry began to ship its products by rail it soon realized that the standard refrigerator car with only 2 or 3 inches of insulation did not adequately protect the product in transit, even when using water ice with 30 percent salt added. As a result, one or two of the major refrigerator car lines were induced to add more insulation in a few of their standard cars. These cars were immediately pressed into service, transporting frozen fruits and vegetables from the West coast to destinations east of the Mississippi River.

As a result of experiments and some test shipments, additional superinsulated refrigerator cars were constructed and, at about the same time, a few trucking companies placed in service some heavily insulated trucks equipped for dry-ice refrigeration. By this time, experience had proved that a proper-type refrigerator car must have a certain number of inches of insulation to minimize heat infiltration, and should be equipped with floor and side-wall racks to permit the free flow of air between the cargo and the floor, sides, and ends of the car. The same requirements, of course, apply to truck bodies. The wisdom of such rigid requirements was supported by the fact that one company pioneering the industry, by virtue of refusing to load anything but superinsulated cars or trucks, is reported to have never had a loss or filed a claim against a railroad for defrosting in transit.

By the end of World War II, the frozen-food industry had expanded to such an extent that there were insufficient superinsulated refrigerator cars and trucks to transport products at the rate of shipment required to keep the trade adequately supplied. This not only forced many shippers to use standard refrigerator cars, but also forced them to use some trucks that were not properly equipped or insulated. The use of these inadequate facilities has caused the loss and deterioration of a considerable amount of products through defrosting in transit.

In the latter part of 1949 there were approximately 2,000 superinsulated refrigerator cars in service in the United States. (See table 10.) At the same time, however, many new companies were engaged in packing and shipping various types of frozen foods. If each packer loaded one car per day for one week, the entire supply of superinsulated cars would be under load. When it is considered that the average number of trips of a refrigerator car under load is approximately 12 per year, it is quite obvious that if shipping is to keep abreast of production, numerous standard cars must be employed.

With the equipment situation such as this, and considering the phenomenal growth of the frozen-food industry, the claims against railroads for loss of products due to inadequate refrigeration are bound to increase in proportion to the industry's expansion. This poses a serious problem for both the frozen-food industry and transportation, as the fact must not be overlooked that when freight rates are analyzed, the claim experience applicable to the product is a factor considered in revising them either upward or downward.

The foregoing discussion is in no sense meant as a criticism of our transportation systems, for the fact must be taken into consideration that the frozen-food industry experienced its great and sudden growth while we were at war, and at a time when there was a shortage of critical materials from which additional rolling stock must be constructed. Then, too, only recently have the frozen-food processors recognized the importance of concerted action in consulting with the transportation agencies on the subject of additional and proper equipment.

Table 10.--Approximate number of heavily insulated refrigerator cars used for frozen-food traffic, 1947, 1948, and 1949 ^{1/}

Car or company initials	Approximate number of cars		
	1947	1948	1949
AMRX	25	25	25
ART	25	22	22
BRE	30	30	29
FOBX	49	59	75
FGE	73	72	170
WFE	101	101	100
GARX	85	63	63
MDT	9	5	5
NRC	49	49	48
NHIX	50	100	99
NWX	55	64	64
NADX	226	226	226
PFE	413	410	404
SFRD	244	244	243
URT	361	383	383
	<u>1795</u>	<u>1853</u>	<u>1956</u>

^{1/} Includes only cars with 6 inches or more of insulation in roofs, sides, ends, or floor.

Source: Based on data from the Association of American Railroads.

In recent years the Association of American Railroads and the U.S. Department of Agriculture have sponsored a move to create a Refrigerator Car Research Committee for the purpose of conducting tests designed to determine the proper amount and types of insulation to use in constructing equipment. Many of these tests have been made and others are under way. Also, in order to increase the number of cars that can be held at low temperatures, a number of car owners and some railroads are going ahead with the construction of some superinsulated equipment. This will at least give some relief to the situation. In spite of this construction program, however, it is likely to be several years before there will be sufficient superinsulated refrigerator cars to handle all of the frozen-food tonnage offered.

Types of refrigerated rail cars.--Most of the heavily insulated cars used to transport frozen foods are larger than the standard car. Their inside dimensions are approximately 50 feet long, 8 feet 8 inches wide, and 6½ feet high, and each car contains approximately 6 inches of insulation. The majority of them have ice bunkers in the ends of the cars,

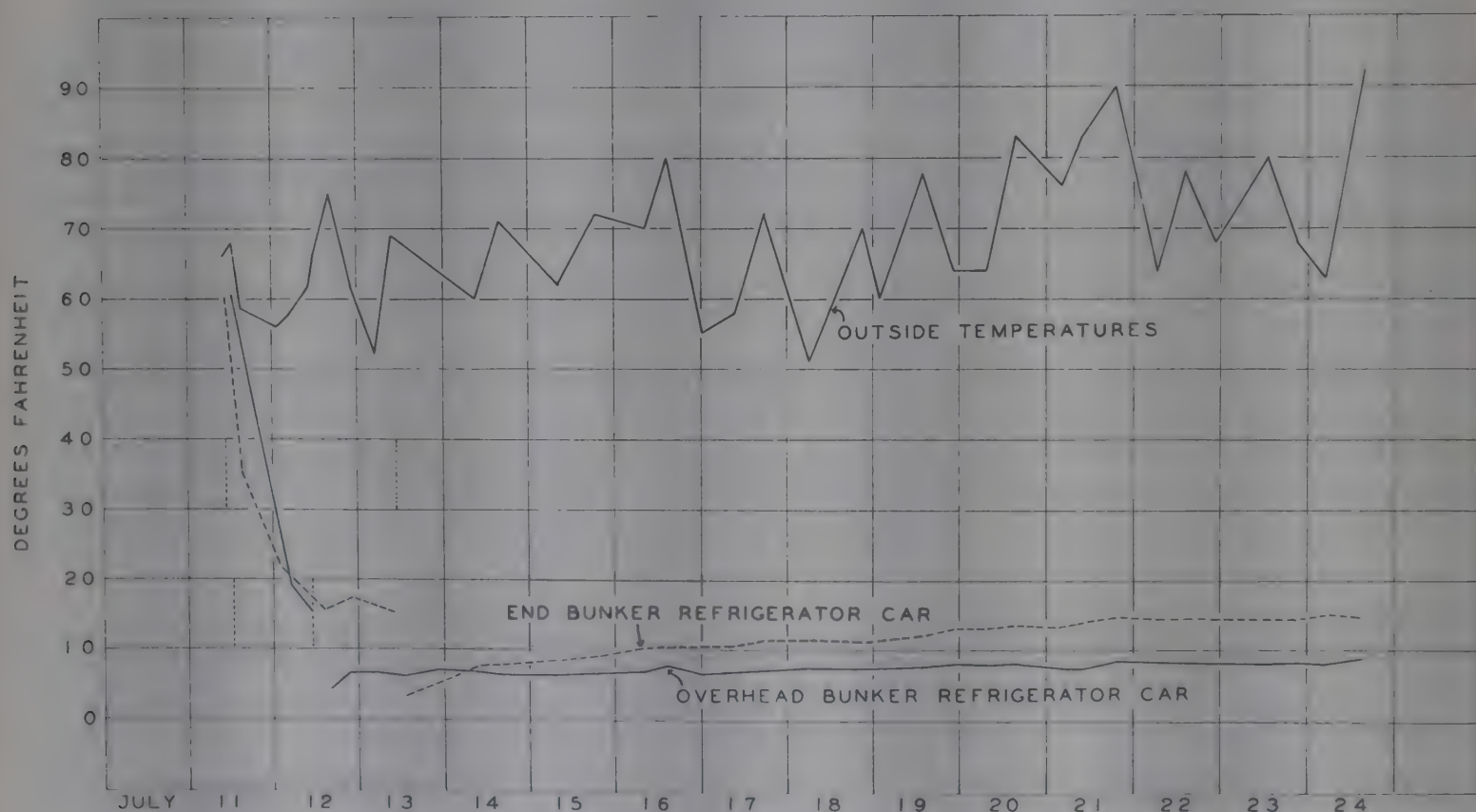


Figure 24.--Results of a transit refrigeration test conducted by the U.S. Dept. Agr. showing the average commodity temperatures existing in two 50-foot, heavily insulated refrigerated cars, one with overhead brine-tank bunkers and the other with end bunkers.

Note - The overhead bunker car was precooled for 22 hours and 45 minutes. The end bunker car was precooled for 47 hours and 20 minutes obtaining approximately the same inside temperatures.

with a capacity of approximately 10,800 pounds of coarse ice. But some have the ice bunkers or ice tanks built in the ceiling of the cars. These are equipped with 10 overhead tanks, each tank measuring 9 feet long, 3 feet 3 inches wide, with an average depth of $9\frac{1}{2}$ inches. The capacity of each tank is 900 pounds of crushed ice.

Standard cars have the bunkers in the ends of the cars and have an average capacity of approximately 10,000 pounds of chunk ice.

In a transit refrigeration test conducted by the U. S. Department of Agriculture in 1945, comparisons of different types of refrigerator cars were made, using two 50-foot heavily insulated cars. One made use of overhead brine-tank bunkers and the other the end-bunkers (fig. 24).

The heavily insulated overhead brine tank car appeared to be the most suitable for the transportation of frozen commodities. The heavily insulated end-bunker car temperatures are quite satisfactory. However, it is believed that if these cars were equipped with air circulating fans, a more even temperature could be maintained throughout the load. The standard refrigerator car with $3\frac{1}{2}$ inches of insulation equipped with air circulating fans can be used, providing there are no long delays in transit and the cars are unloaded promptly on arrival at destination.

Icing service.--In shipping fresh and frozen foods, the railroads furnish one of three sizes of ice to be placed into the bunkers of the refrigerator cars, the exact size depending upon the temperature to be maintained en route. The uses of the different sizes of ice are as follows:

(1) Chunk ice, broken into pieces not to exceed 100 pounds, is most commonly used for the protection of fresh fruits and vegetables, unfrozen meats, poultry, fish, and eggs.

(2) Coarse ice, broken into pieces averaging from 10 to 20 pounds, is used mostly in the end-bunker cars when salt is added and low temperatures are desired.

(3) Crushed ice, broken into pieces averaging the size of a man's fist, is used in the overhead bunker car when salt is added and low temperatures are desired.

Icing service is provided by the railroads at a stated charge per carload, as published in the National Perishable Protective Tariff. Under this service for frozen foods, the cars are initially iced prior to loading (See table 11.) then replenished with ice and the necessary percentage of salt added immediately after loading, and re-iced with approximately 30 percent salt added at all regular icing stations along the route traveled.

Under normal conditions refrigerator cars are precooled from 24 to 48 hours prior to loading. Although adequate precooling is important,

Table 11.--Steps in initially icing end-bunker refrigerator cars, showing amount and size of ice, and amount of salt used

Step	Ice pounds	Size of ice chunks	Salt pounds
1	1,800	20- to 50-lb.	None
2	900	20- to 30-lb.	800
3	900	10- to 20-lb.	300
4	900	10- to 20-lb.	300
5	900	10- to 20-lb.	300
6	900	10- to 20-lb.	300
7	750	10- to 20-lb.	315
Totals	7,050 (Approx. bunker capacity)		2,115

Source: Unpublished data U.S. Dept. Agr., Production and Marketing Administration, Marketing Facilities Branch.

it has been found that precooling for longer than 24 hours appears to be a waste of refrigeration when the cars are later opened for 2 or 3 hours for loading.

The cost to the shipper of transporting frozen foods by rail is governed by established freight rates and refrigeration charges. These rates vary between shipping routes and according to distance, and there is a 50 percent addition to the standard refrigeration charge when 30 percent salt is used, as is always the case when transporting frozen foods. General cost data between various points in the United States is shown in table 12.

Rail movement of frozen foods across country.--It might be of interest to follow a carload of frozen foods on a trip from a packer in Oregon to a wholesale distributor in Jersey City, N. J.

The first step is for the packer to order a refrigerator car to be precooled for at least 24 hours. This is designed to remove as much heat as possible from the inside walls, floor, and ceiling of the car. Billing instructions will call for the car to move under standard refrigeration, with 30 percent salt added.

After precooling, the car is set at the platform of the packer's warehouse and is ready for loading, but not until it has been inspected to see that it is equipped with floor racks and side-wall strips, racks, or flues, and that there is nothing under the floor racks that might impede air circulation. When end-bunker cars are used it is important to see that there is no surplus salt under the drip racks of the bunker. Also the drains should be clean and free from debris. During loading a canvas curtain split down the middle is often placed over the open door to conserve as much cold air in the car as possible.

Table 12.--Transportation rates and refrigeration charges for hauling frozen fruits and vegetables between selected points by rail, as of Jan. 10, 1949

Route	Rate cwt.	Load (minimum weights) ^{1/}	Total rate for load	Refrig- eration charge ^{2/}	Total charge per car	Total charge per cwt.
	<u>Dollars</u>	<u>Pounds</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
From Hillsboro, Oreg., to:						
Denver, Colo.	1.55	46,000	713.00	103.16	816.16	1.77
Kansas City, Mo.	1.55	46,000	713.00	119.03	832.03	1.81
Chicago, Ill.	1.61	46,000	740.60	132.92	873.52	1.90
Pittsburgh, Pa.	1.61	46,000	740.60	138.86	879.46	1.91
New York City	1.61	46,000	740.60	158.70	899.30	1.96
From Hammond, La., to						
Denver, Colo.	1.70	36,000	612.00	143.83	755.83	2.10
Kansas City, Mo.	1.24	36,000	446.40	132.92	579.32	1.61
Chicago, Ill.	1.14	36,000	410.40	132.92	543.32	1.51
Pittsburgh, Pa.	1.29	36,000	464.40	138.86	603.26	1.68
New York City	1.39	36,000	500.40	143.83	644.23	1.79
From Eagle Pass, Tex., to						
Denver, Colo.	1.68	36,000	604.80	101.18	705.98	1.96
Kansas City, Mo.	1.48	36,000	532.80	101.18	633.98	1.76
Chicago, Ill.	1.54	36,000	554.40	111.09	665.49	1.85
Pittsburgh, Pa.	1.96	36,000	705.60	121.02	826.62	2.30
New York City	2.23	36,000	802.80	132.92	935.72	2.60
From Fairmont, Minn., to						
Denver, Colo.	1.18	36,000	424.80	103.16	527.96	1.47
Kansas City, Mo.	.73	36,000	262.80	94.23	357.03	.99
Chicago, Ill.	.74	36,000	266.40	94.23	360.63	1.00
Pittsburgh, Pa.	1.09	36,000	392.40	109.11	501.51	1.39
New York City	1.34	36,000	482.40	123.32	605.72	1.68

^{1/} Minimum weights vary on commodities from different sections of the country and are governed by the railroad tariffs applicable from shipping areas.

^{2/} 30 percent salt.

Source: Unpublished data, U.S. Dept. Agr., Production and Marketing Administration, Marketing Facilities Branch.

At some warehouses rail cars are loaded by means of a gravity (or power) conveyor system running from the storage room directly into the car (fig. 25). At other warehouses hand trucks, jacks and skids, or mechanical trucks and palettes are used. Whatever the system used shippers and warehousemen can contribute much in preserving quality by loading cars as quickly as possible, and protecting merchandise from the sun and warm air by the use of a canopy over the conveyor, or by so arranging the loading schedule that the food will move directly from warehouse to car without standing unprotected on the platform. After the car is loaded, a recording thermometer might be installed; when the doors are securely fastened and sealed, the car is ready to move.



Figure 25.--Frozen foods are frequently moved from an anteroom of a refrigerated warehouse through a canvas canopy directly into a precooled refrigerated rail car.

The route selected from Oregon to New Jersey may be as follows: From Portland, Oreg., to St. Paul via Great Northern; from St. Paul to Chicago via CB&Q; from Chicago to Jersey City via New York Central. This routing goes through the Northern and Midwestern States, where outside temperatures encountered in July may range from 62° to 95° F.

Along this route the railroad companies have established icing stations, approximately 24 hours running time apart, to replenish ice and salt as necessary. During the course of travel from point of origin to destination, 12 different icing stations are encountered, at which points the hatch covers are opened and the hatch plugs removed.

In a test case, ^{9/} the total time required for icing a car along the route was 7 hours and 33 minutes. The number of icings, including the initial, was 13, and an average of six men participated in the task at each station. Total standing time in the various yards and along the route was 113 hours between Hillsboro, Oreg., and Cincinnati, Ohio. In comparison, the actual running time between these two cities was 104 hours for the distance of 2,891 miles. Standing time is particularly significant in rail cars that provide air circulation (by use of fans) that is dependent on the wheels of the rail car for driving power.

^{9/} Unpublished data, U.S. Dept. Agr., Production and Marketing Administration, Marketing Facilities Branch.

When the product was loaded into the car at origin it was removed from a cold-storage warehouse where it had been under a temperature of approximately 0° F. for several months. Upon arrival at destination inspection indicated that the product temperature was about 19° F. and the air temperature in the car, about 22° F. Attention is directed to the fact that while the air temperature in the car upon arrival was 22° F., the product had itself contributed 19° F. of its temperature.

The recording thermometer indicated that the air temperature in the car after re-icing at Portland was approximately 15° F. The thermometer tape showed a destination air temperature of about 22° F., but there were many points on the tape between origin and destination that showed a sharp rise in temperature, in some cases as high as 28° F. In checking the tape with the car schedule, it was found that these peaks in car air temperature occurred at the icing stations. It is logical to assume that these increases in temperature occurred when the plugs were removed and remained out long enough for the ice to be tamped down in the bunkers and additional ice and salt added.

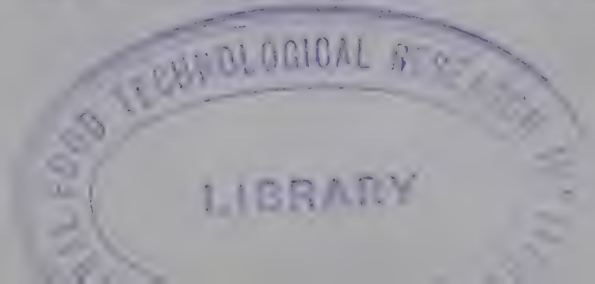
Upon arrival in Jersey City the frozen foods were placed in a warehouse in which the standard temperature is 0° F. and here a major fluctuation in product temperature is experienced. The frozen foods have gone from about 0° F. at origin to an average for the car of 19° F. en route, and back to about 0° F. again for first storage at destination.

Upon unloading the car, the same protection should be afforded the lading as was afforded at point of origin by -

1. Arranging to unload the car as quickly as possible.
2. Moving truck or skid loads direct from the car into the cold-storage room without permitting them to remain on the platform any length of time.
3. Providing as much protection as possible from sun and warm air while trucks and skids are en route from the car to the warehouse door.

These frozen foods will probably remain in the zero temperature for a few days, a few weeks, or possibly a few months. Then they will be subjected to one of two additional moves - short hauls to the wholesalers' premises or long hauls to outlying distribution centers. These hauls, both short and long, are usually made by truck. When the frozen foods reach the wholesalers' zero storage room it is likely that the temperature of the product will have risen to plus 7° to 10° F.

When the merchandise is delivered from the zero temperature of the warehouse to the truck, here again is an opportunity for the temperature to fluctuate if the loaders fail to load the truck promptly and keep the doors open as short a time as possible.



3. Intelligent addition of salt at the right time and in the proper proportion.

Quite frequently, temperature failures may be attributed to unskilled handling at the icing stations en route.

Experiments with new methods of refrigerating cars.--In an effort to improve further facilities for transporting frozen foods several carrier lines have experimented with methods of refrigerating cars that are revolutionary when compared with the conventional ice and salt method. Although these new methods differ materially from one another in the techniques employed, the objective remains the same - to keep the temperature of the commodity down to 0° F. and yet not incur prohibitive cost. One of these new experimental refrigerator cars (figs. 26 and 27) was subjected to various tests by the U. S. Department of Agriculture in February of 1947 and revealed the temperatures as shown in figure 28.

The records show that, under conditions of the test, the average top commodity temperatures ranged from about 4° below to nearly 1° above zero F.; the bottom commodity temperatures ranged from about 3° below to about 3° above zero F. These low temperatures are especially significant when it is considered that the temperature outside of the car (and inside the test house) was held at about 92° F. for the 10-day test period.

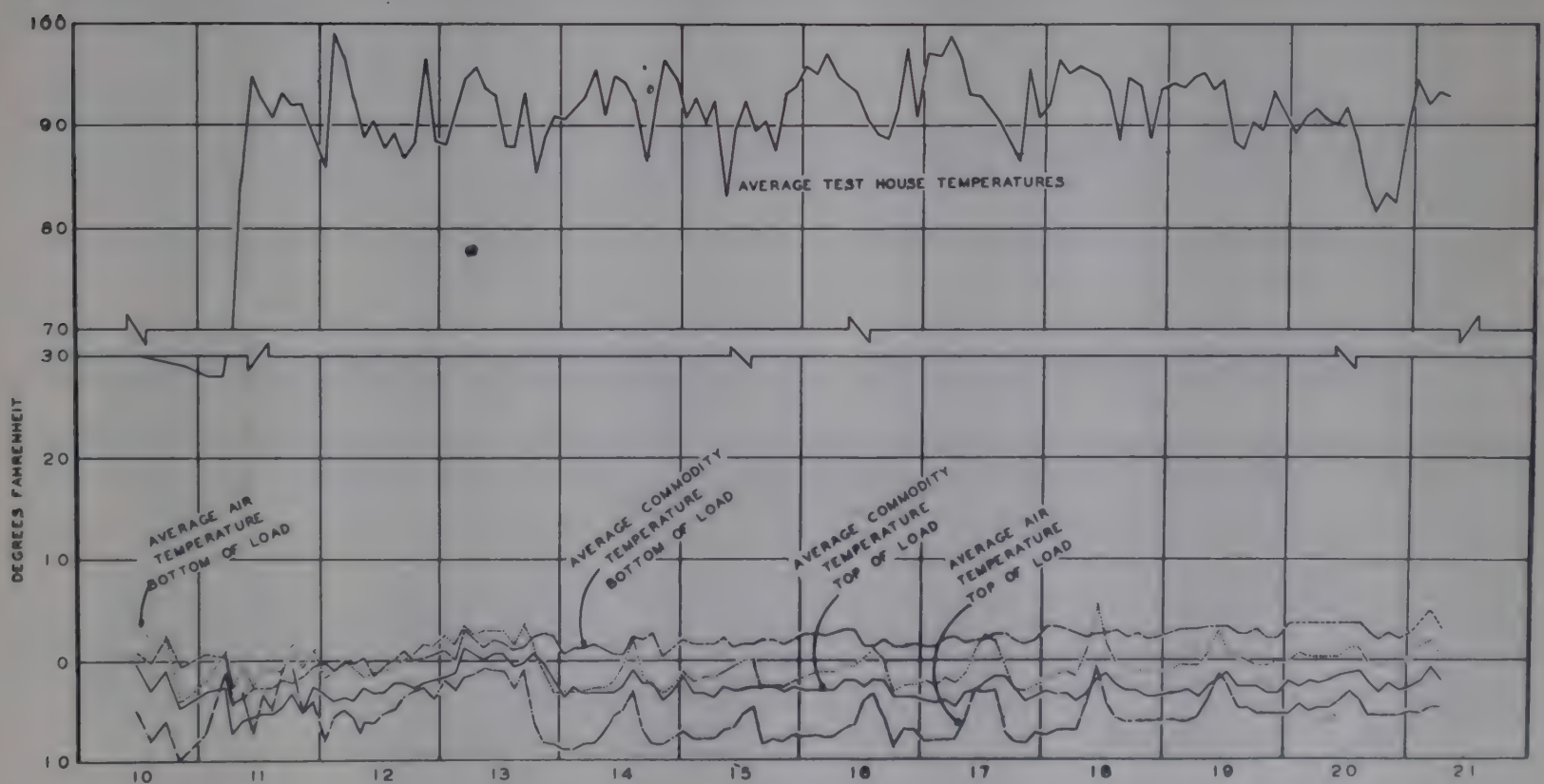


Figure 28.--Average air temperature in the test house, and average air and commodity temperatures in the split-absorption experimental refrigerator car during the test.

This experimental car was equipped with a refrigerating system without moving parts, and without power requirement. Refrigeration was achieved with a split absorption system using anhydrous ammonia - a new application of an old refrigeration principle.

Truck Facilities

Truck transportation for the most part has been limited to short hauls. The main use of trucks is to move frozen foods in less than carload quantities for distances of less than 500 miles. Like the facilities for rail transportation the facilities for truck transportation are still inadequate to meet the needs of the frozen-food industry. Although in many instances the temperatures attained by refrigerated trucks are lower than those attained in rail cars, many trucks carrying frozen foods do not keep the temperature on long hauls constantly down to 0° F.

Ordinarily trailer trucks will haul more than half as much as a standard refrigerated rail car, or about 22,000 pounds. The exact amount carried is often determined by State laws which regulate the load limits on highways. In spite of the load limitations of refrigerated trailers their use in transporting frozen foods has experienced considerable growth in the last few years. This growth in the use of trucks can be attributed to several reasons:

1. They are speedier on most hauls. On the national survey it was found that many packers and distributors were using trucks because of their adaptability to overnight hauls between cities where shipments by rail cars would take several days.
2. They reduce extra handling where facilities lack rail connections. As discussed in a later chapter trucks can go direct from one facility to another. This is often impossible in rail transportation where plants do not have rail sidings.
3. Frequently they are capable of maintaining more desirable temperatures. The increase in the number of trailers with heavy insulation and with dry-ice bunkers or mechanical refrigeration units has been much greater than for rail cars equipped for low-temperature transportation.
4. Generally they are more economical on short hauls. For short distances the cost to the shipper is frequently less for truck than for rail; how much less depends on many variables, such as load carried and the rail rate for the same route.
5. Trailer trucks are a more flexible means of transportation. From the standpoint of flexibility of operation the refrigerated truck is indispensable in supplying points that need less than carload shipments and in supplying areas where rail connections are such that unnecessary delays and expenses are incurred.

Trailers for the long-distance hauling of frozen foods are of two general types - those that are refrigerated by mechanical means and those that are only insulated and use dry ice as a means of obtaining low temperatures. Many refrigerated trucks are constructed for cooler temperatures only and are not suitable for transporting frozen commodities. Those that are mechanically refrigerated are similar to the one shown in figure 29, which has a compressor driven by a four-cylinder gasoline engine. While the low temperature in some truck bodies is acquired by means of a refrigerant, circulating through coils, many trucks use the air-blast system, with space around the walls and floor for air circulation. Trucks refrigerated with dry ice usually have racks for placing the ice around the load, but in some instances the ice is placed directly on the top and sides of the load. As previously pointed out, the biggest difficulty with the mechanically refrigerated system is that the moving parts are subject to breakdown and repairs. Although the use of dry ice is reliable most of the time, there is some difficulty involved in supply and in knowing what amount to use under circumstances of different thicknesses of insulation, varying lengths of time on the road, and the amount of frozen foods to be transported.



Figure 29.--Refrigerated trailer trucks are economical and flexible for use on short hauls. The two common methods of refrigeration are by the use of dry ice and mechanical units. The mechanical unit installed in the front of this trailer body is capable of holding the temperature near 0° F.

Another phase of transportation which has presented some serious problems is the movement of so-called overnight shipments in small lots, either by Railway Express or in less than truckload quantities. Even though dry ice might be used in an effort properly to refrigerate shipments of this kind, extreme caution must be exercised as to the types of shipping containers used. If ordinary fiberboard shipping containers are used without any additional protection, it is almost a foregone conclusion that the product will be delivered in at least a semidefrosted condition.

Water Transportation Facilities

Many members of the frozen-food industry have often wondered about the feasibility of moving frozen foods from the West-coast producing areas to the East-coast consuming areas by water transportation. Although water transportation, up to this time, has played little part in

the movement of frozen foods, for domestic consumption, the successful handling of frozen foods to combat areas during World War II has proved that it has good possibilities for success in peacetime uses.

In the future, intercoastal steamship companies, and possibly inland water route operators, may be in a position to offer to the frozen-food industry certain types of ships and barges partially or completely insulated, and so refrigerated as to maintain a zero temperature. The likelihood of this may become more manifest when the industry reaches the point where it will be advisable to move large quantities of frozen foods from, to, or between the Atlantic and Pacific coasts, and possibly the Gulf ports. In connection with this type of movement, however, there are certain economic factors that must be settled before the success of such service can be assured.

Air Transportation

Little can be said of air transportation of frozen foods at this time, although some trial shipments have been made. It is known that the air lines can offer speed and proper temperature, but the rates presently quoted for this service are too far out of line with other modes of transportation to enable the air lines to capture an appreciable volume of frozen-food traffic, especially in view of the fact that extreme speed is not necessary in the transportation of frozen foods held at proper temperatures.

Method of Transportation by Which Wholesalers Receive Frozen Foods

In the survey of wholesalers of frozen food it was found that 45 percent of those visited receive at least three-fourths of their supplies by refrigerated rail cars, the balance arriving by refrigerated trailer trucks. The extent to which they use rail or truck transportation in receiving shipments of frozen foods varies between cities. Wholesalers located in cities such as New York, Philadelphia, and Chicago, which are large terminal markets, and who have to bring a substantial part of their supplies long distances, receive their frozen-food shipments mostly by rail. This is also true of those wholesalers located in cities which are on important rail lines, such as Omaha, Kansas City, Memphis, and Cincinnati. On the other hand, wholesalers operating in cities such as Seattle and Portland, which draw most of their frozen foods from nearby producing areas, take advantage of the flexibility of truck receipts to bring in supplies. There are a few cities outside of the heavy producing areas, however, that receive their frozen foods primarily by truck even though they are serviced by rail. For example, Richmond, Va., Louisville, Ky., and Columbus, O., have good rail connections but receive most of their frozen foods by truck. One reason for this is the organizational tie-in in these places between the wholesalers of frozen food and wholesalers in nearby cities. Usually a central buying office procures all the frozen-food requirements for their entire organization and stores them in one of the larger cities. The affiliated wholesalers in nearby cities are then supplied from there

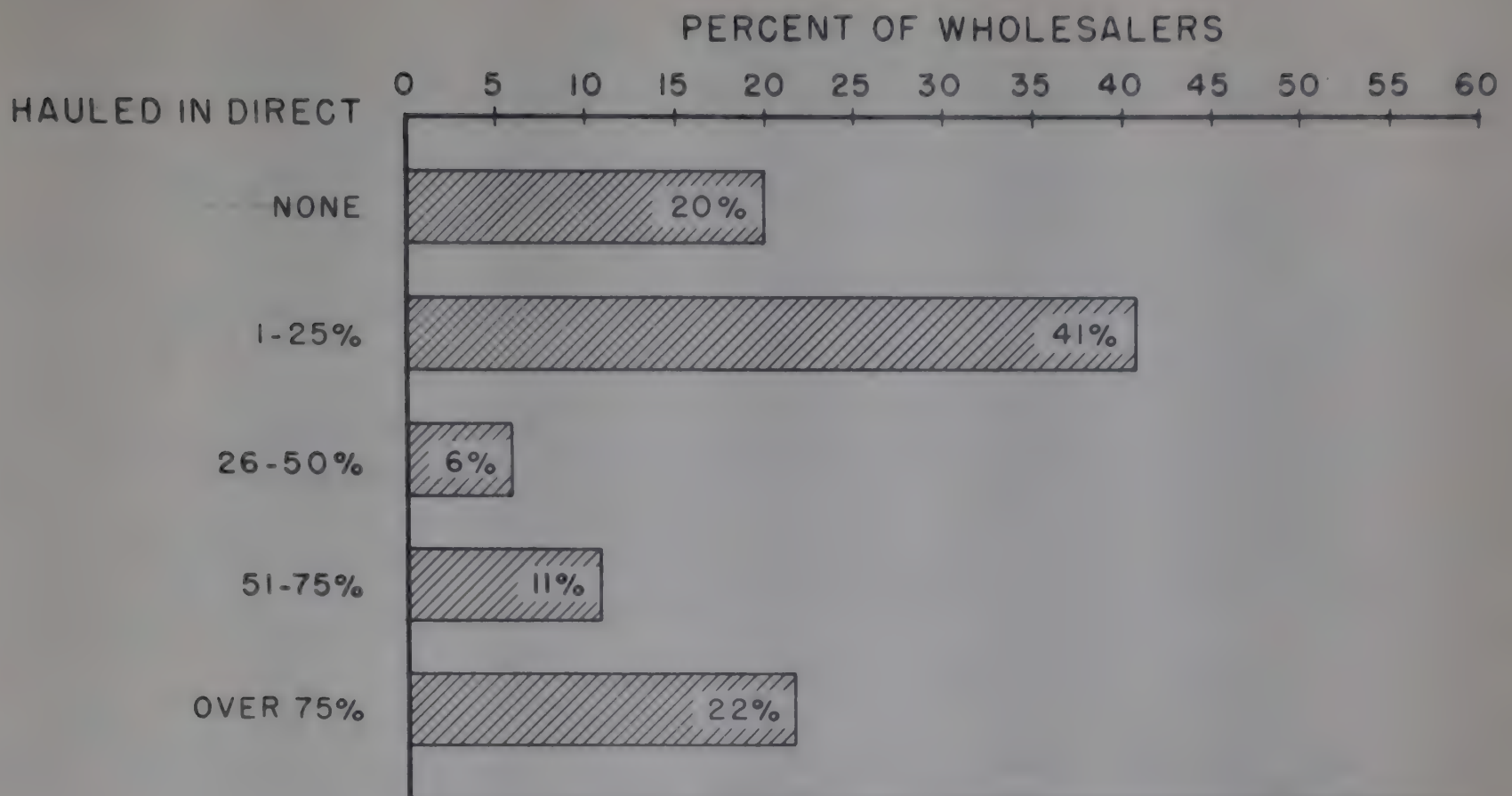


Figure 30.--Percentage of receipts hauled direct to private facility of wholesaler.

by truck. Another reason for heavy truck receipts in some cities that have good rail connections is that they have a limited amount of long-term storage space available in that locality. Under such circumstances the wholesalers find it necessary to store their frozen foods in the nearest city that has sufficient storage accommodations and then to haul them periodically by truck. A few cities have such poor rail connections and warehouse facilities that the wholesalers must depend almost entirely on truck receipts.

Practically none of the wholesalers who rent operating space in public refrigerated warehouses receive their shipments direct to their operating space. Instead, their receipts are sent to public storage rooms where they are held by warehousemen until the wholesalers are ready for them. However, many of the frozen-food wholesalers who have their own private operational facilities receive at least part of their frozen-food shipments direct to their plants. As shown in figure 30, two-fifths of these wholesalers receive more than 25 percent of their merchandise in this manner.

Those receipts of wholesalers who depend mostly on rail shipments, usually go first to warehouse general storage. But almost one-half of the wholesalers who receive shipments primarily by truck get the greater part of their supplies direct at their plants (fig. 31).

The most important reason for more shipments not arriving direct to the wholesaler's plant is limited facilities for receiving and storing merchandise in large quantities.

Summary

In short, the transportation needs of the frozen food industry are:

1. Railroad refrigerator cars that can maintain a zero temperature in transit.
2. More superinsulated trucks in which zero temperature can be maintained.
3. More extensive use of improved types of containers for LCL shipments in which zero temperatures can be maintained.
4. A thorough understanding of the nature of the product by operators of railroads and trucking companies.
5. As low-cost transportation as possible.
6. Last, but not least, full realization on the part of everyone handling frozen foods from the time they are produced until they reach the ultimate consumer that temperatures above zero are usually enemies of the product.
7. More and efficient facilities for handling frozen foods at wholesale plants.

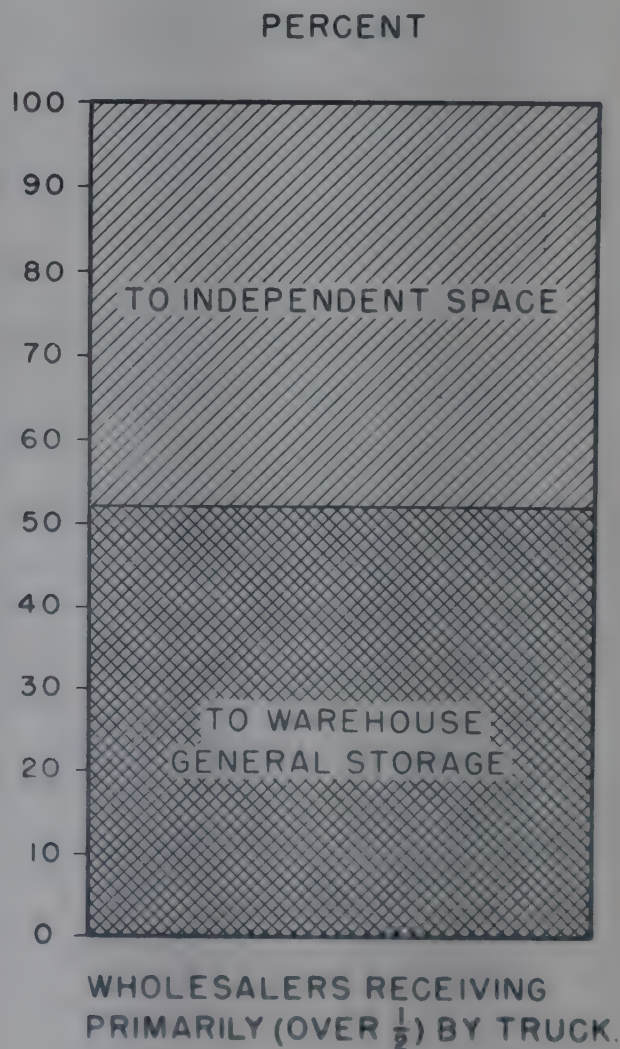
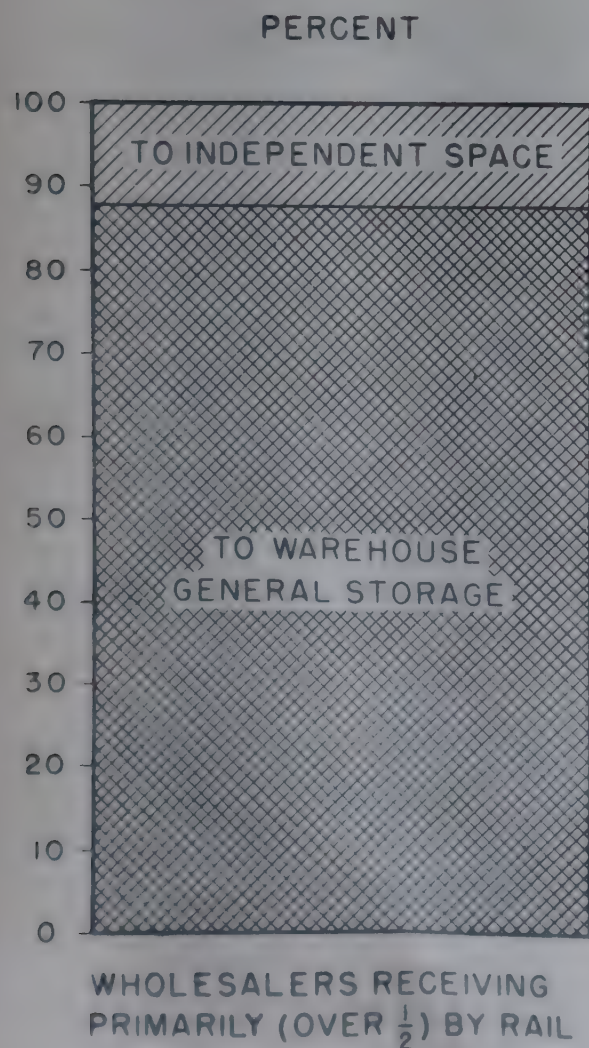


Figure 31.--Percentage of frozen-food wholesalers with plants independent of public refrigerated warehouses compared as to truck and rail receipts.

WAREHOUSE FACILITIES 10/

Importance to Frozen Food Distribution

One of the fundamental ideas behind the freezing of foods is to increase the storage life of the fresh commodity. In this respect it can be seen that the refrigerated warehouse is indispensable in the marketing of frozen foods. The time spent in a warehouse by a frozen commodity is perhaps of longer duration than all the rest of the time from processor to consumer. Thus, the effect of storage on the quality of the product and on the cost of marketing is of extreme significance. Not only is it necessary that warehousemen furnish the proper storage conditions as regards temperature, humidity, and sanitation, but it is equally important that the facilities are structurally adapted and arranged geographically to promote the efficient flow of frozen foods from producer to consumer.

The present network of refrigerated warehouses, which spreads over the entire country, was for the most part in existence for some time before frozen foods became established as an integrated industry. How well this system of warehouses is arranged to serve its function in the distribution of frozen foods is frequently a subject of some controversy. But, at any rate, it is generally recognized that the effectiveness of warehousing will have a great effect in determining how fast the frozen-food industry will grow in the future.

The Function of the Warehouse in Frozen-Food Distribution

The refrigerated warehouse functions in two major capacities in the marketing of frozen foods. First, it serves as a facility for storing the frozen products from one producing season to the next, and second, it aids in their wholesale distribution.

Function as a storage facility.--Refrigerated warehouses originally came into existence principally as a means of further lengthening the life of unfrozen perishable products. It was this use that brought about the initial growth of the industry shortly after the turn of the century. However, by the early 1920's the growth of warehouse space was exceeding the demand, and the industry was so overexpanded that many companies suffered serious financial difficulties. It was about this time that the freezing of foods was gathering momentum, and the storage of frozen products became the salvation of many in the industry.

In 1947, there were an estimated 1,781 warehouses in the United States, with an aggregate of over 675 million cubic feet of space. For the most part, these storage facilities were situated at points that were strategic in the commerce of perishable commodities, that is, at locations corresponding to areas of production, at in-transit points along the route from producer to consumer, and in the large metropolitan sections of the country.

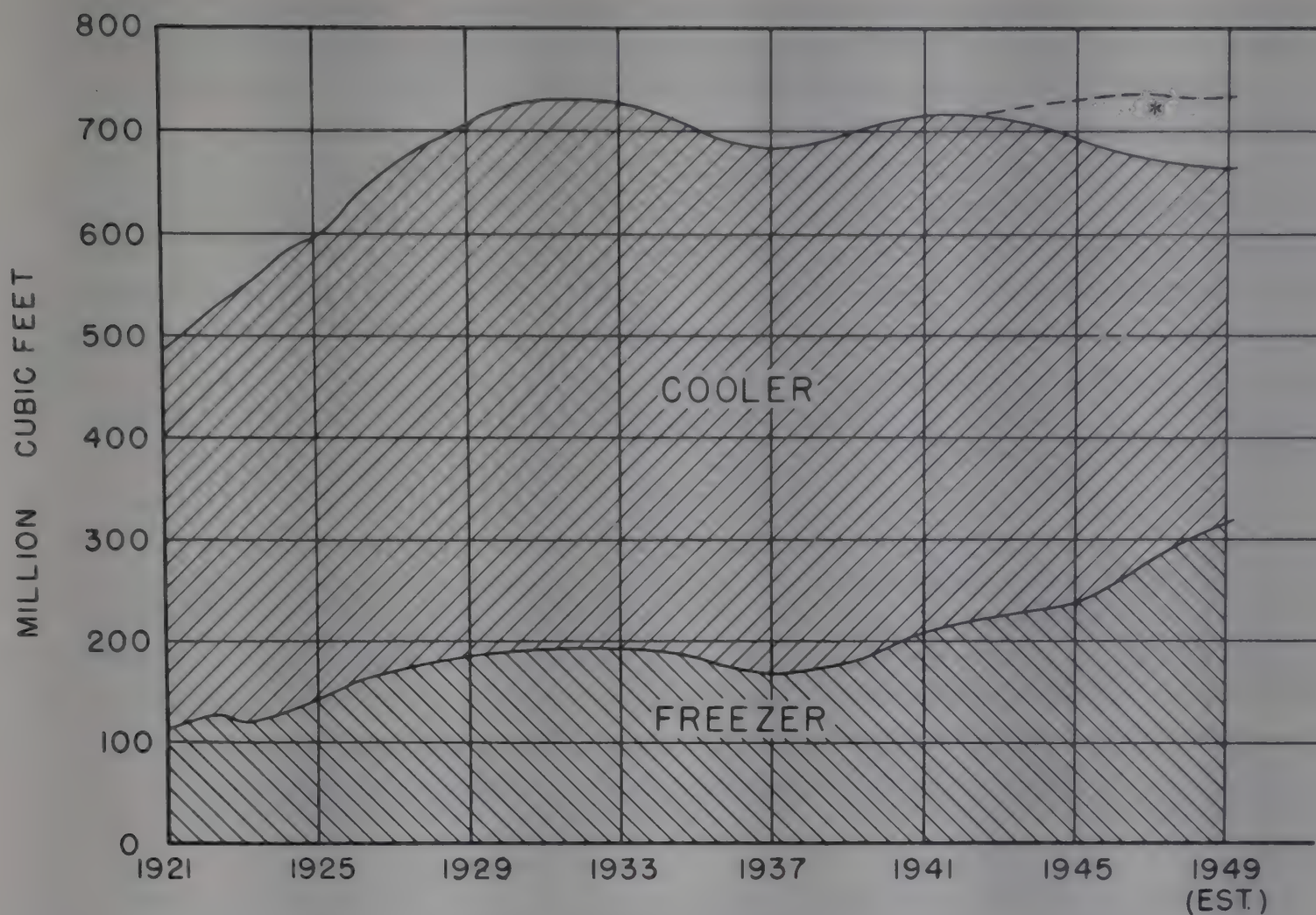
10/ All data in this chapter, except as otherwise indicated, are taken from cold storage reports and space surveys of refrigerated warehouses published by the U. S. Dept. Agr., Production and Marketing Administration, Marketing Facilities Branch.

As the storage of frozen perishables increased in volume, changes became necessary in some warehousing techniques. Scientists found that a temperature of zero degrees or lower is imperative for the long holding of most frozen products, that temperature fluctuations must be kept to a minimum, and that proper humidities need to be maintained. In many cases new handling methods and equipment were necessary because frozen foods were packaged differently from commodities previously stored in large quantities. Also, the storage life of most frozen foods is considerably longer than the fresh unfrozen product; therefore, the need for different consideration in this respect.

Inasmuch as refrigerated warehouses store numerous commodities other than frozen foods, much of the warehouse space is held at temperatures above freezing. Since it is a general practice to store frozen foods at a temperature of zero degrees or below, the primary concern in this discussion is with warehouse space commonly held at that temperature and such space is referred to as "sharp freezer." Space held at above zero degrees and below 29° will be referred to as "regular freezer." All space ordinarily held at any temperature below 30° F. is generally referred to as "freezer." Refrigerated space above 29° F. is regarded as "cooler space" and will be referred to as such. In 1947, the relation of these three types of space in all types of refrigerated warehouses for the country as a whole was: 22 percent sharp freezer space (0° F. and below), 14 percent regular freezer space (0° to 29°), and 64 percent cooler space (above 29° F.). Although at one time most of the warehouse space was designed to operate either as cooler or as freezer and was not interchangeable, much of the warehouse space constructed in recent years has been "convertible" space, that is, it can be held at sharp freezer, regular freezer, or cooler temperature.

The growth of freezer space in refrigerated warehouses has been rapid since the introduction of frozen foods some 30 years ago. In 1949, refrigerated space held below 30° F. amounted to 40 percent of all refrigerated space in all warehouses, as compared with 21 percent in 1921 (fig. 32). The proportion of freezer space held below zero degrees had increased rapidly in the past 5 years. In 1947, it amounted to two-thirds of all freezer space.

In order to get a true picture of the storage of frozen foods, consideration must be given to the extent that freezer space in warehouses has been occupied. The mere existence of such space does not mean much unless it is known how completely it is filled with frozen foods during their seasonal movement into and out of storage. Figure 33 shows the quantity of each of the six principal freezer items held at temperatures of 29° F. or below in public refrigerated warehouses in the United States. This figure indicates the increase in volume of freezer stocks between 1921 and 1947. It should be noted that not all commodities in freezer storage are marketed as frozen foods. Items such as meat carcasses, cream, creamery butter, and lard are held frozen in storage but are thawed out and frequently further processed before being marketed. However, most of the foods held at temperatures below freezing are products that are delivered to users as frozen foods. This is true of all of the vegetables and fruits.



*(Since 1943 cooler working rooms of meat-packing warehouses have been excluded as available storage space)

Figure 32.--Gross space in refrigerated warehouses, United States, 1921 - 49

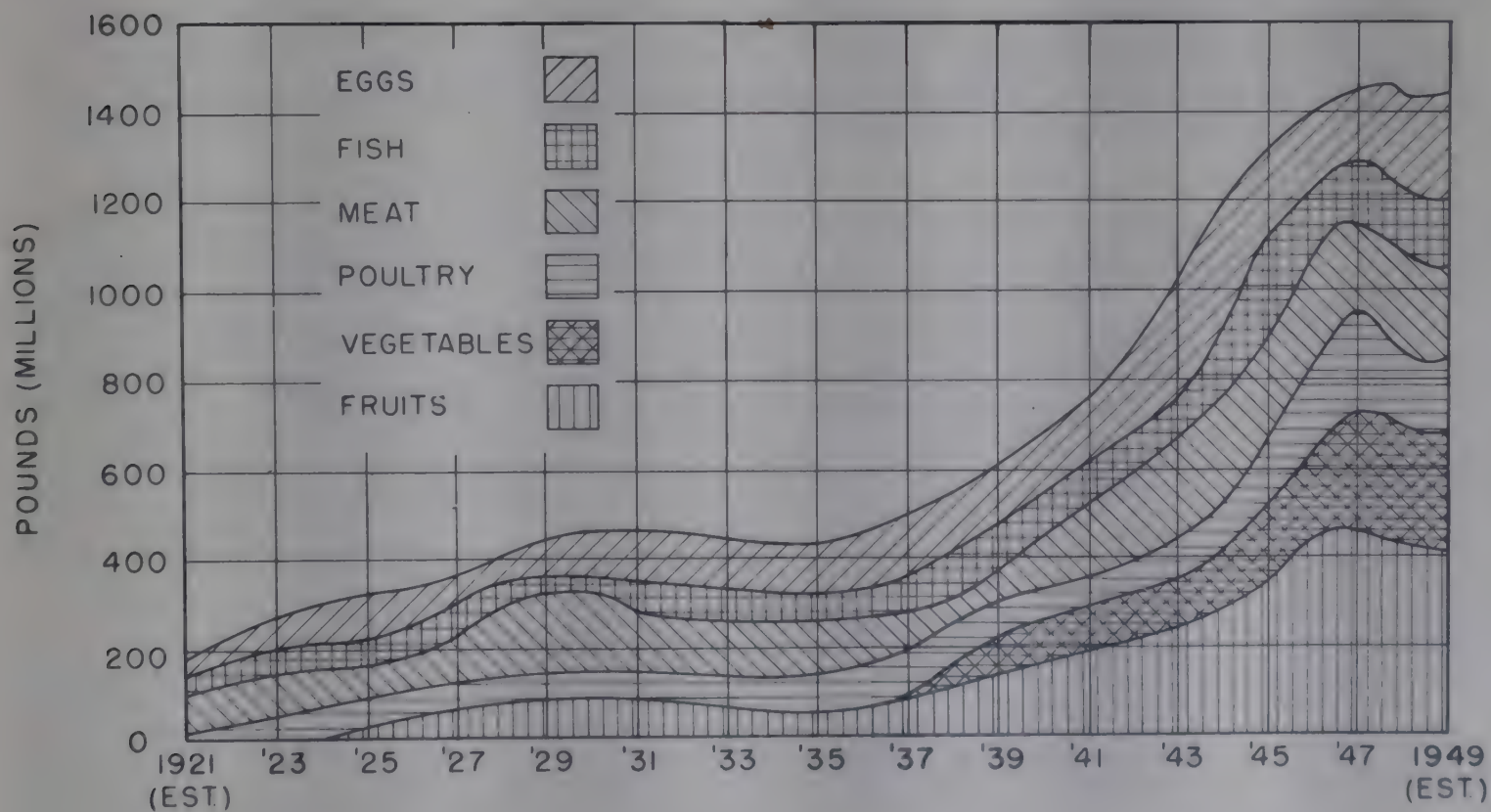


Figure 33.--Storage of six principal freezer items 1921 - 49

Source: Information on fish compiled from reports from Fish and Wildlife Service, Dept. Int.

Trade figures have indicated that during the 1920's and early 1930's, freezer space was usually about 50 percent occupied. In the few years prior to 1939, freezer occupancy averaged 60 percent; but as a result of wartime conditions, by 1946 the occupancy reached 90 percent, which is just about the maximum. During the 10-year period preceding 1940, holdings of the seven main freezer commodities increased 20 percent by weight. Figure 34 shows the percentage of occupancy in public cold-storage warehouses for the period 1944-48.

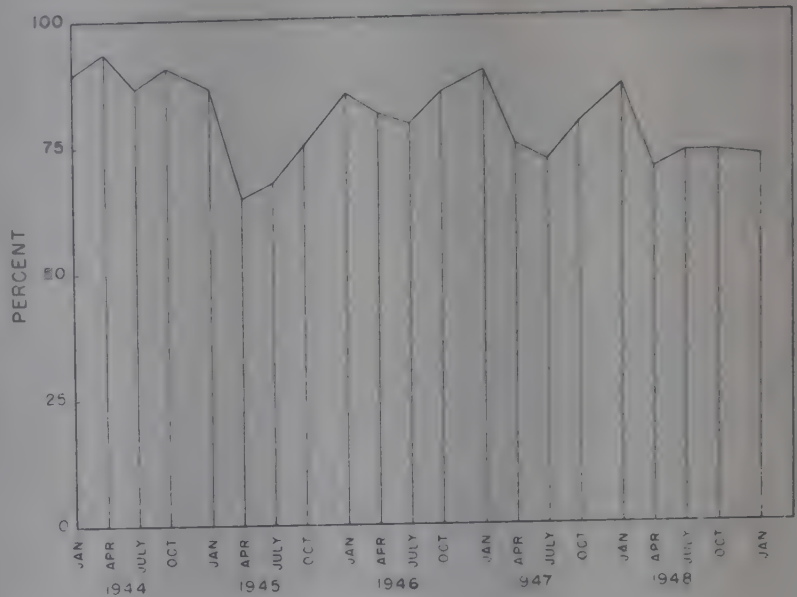


Figure 34.--Percentage of occupancy of freezer space in public refrigerated warehouses, 1944 - 48.

From the standpoint of increasing the efficiency of frozen-food distribution, there is a need to find the answer to some problems concerning warehouse location. For example, when additional storage facilities are needed, where are the best places to build them? In the producing area? In the in-transit area, or in the consuming area? A recent survey of frozen-food distribution in the United States indicated that there was excessive moving of frozen foods into and out of storage. This extra movement of stocks could be partly due to the location of present warehouse facilities. In the event that additional warehouses are necessary in the light of a growing frozen-food industry, then it would be best to construct these facilities at geographical locations that would contribute most to the ease and economies of distribution.

The function of the warehouse as an aid to wholesale distributors.--

Many warehousemen rent refrigerated space to wholesalers for use as operational facilities. This space is used as working areas for the wholesalers to assemble and dispatch orders. Refrigerated rooms for short-term storage are also rented to the wholesaler for the holding of supplies from which he assembles his daily orders. Even a few of the wholesalers who operate from independent facilities are dependent on the nearby warehouse for refrigeration, which is piped into the operator's establishment from the warehouse plant.

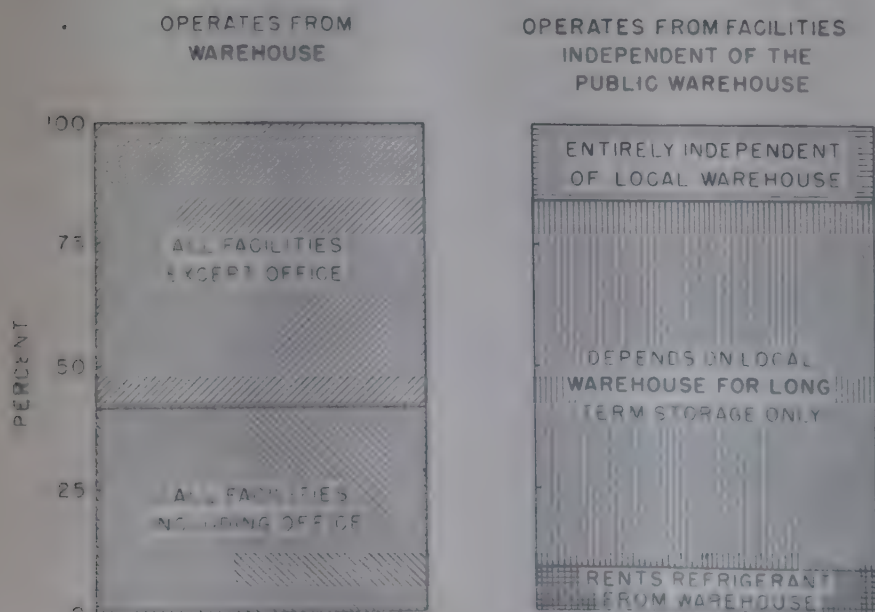


Figure 35.--Proportion of frozen-food wholesalers who operate from public warehouses and use independent facilities.

In furnishing these facilities to distributors, warehousemen have been instrumental in fostering frozen-food expansion, for they have made it

unnecessary for the frozen-food industry to be burdened during its experimentation stage with the expense of creating new operational facilities. Of course, the extent to which the wholesale distributor takes advantage of warehouse facilities is quite varied. Thirty-six percent of the 315 frozen-food wholesalers covered in the recent survey use the warehouse almost entirely as an operational facility. Forty percent of these distributors who operate from the warehouse also rent office space on warehouse premises (fig. 35). In addition, 10 percent of the distributors who operate from independent facilities rent warehouse storage space to supplement their own. Of course, whenever a wholesaler uses the warehouse, he pays in the form of rent and other fees. The conditions under which he can best use the warehouse facilities or use his independent plant have become quite controversial. Certainly there are optimum conditions for each. Although this subject will be treated more fully in a subsequent chapter, it is appropriate to state here that there is need for further detailed inquiry to determine what underlying economic factors are involved in deciding to what extent a wholesale plant should be dependent upon the public warehouse.

The Flow of Frozen Foods through Refrigerated Warehouses

If foods were produced and frozen in the same general area where they are consumed, then the flow from producer to consumer would be greatly simplified. However, as things actually exist, the populous areas of consumption are, for the most part, widely separated from the areas where production is concentrated. A frozen-food distributor in New York City might receive frozen fish from Alaska, meat from Kansas City, poultry from Georgia, eggs from Arkansas, cherries from California, peas from New Jersey, and French fried potatoes from Maine. Such wide distances between areas of production and areas of distribution make the flow of frozen foods through the marketing channels very complex, and as a result the location of refrigerated storage space plays a very important part in determining the extent and direction of the flow of frozen foods.

Table 13 shows how sharp freezer space changed in each of the geographic regions in the 9-year period, 1939-47. The geographic location of sharp freezer space in 1947 is shown in figure 36 and is compared with regular freezer and cooler space. It can be seen from this latter illustration that the Middle Atlantic and East North Central regions account for 50 percent of the total sharp freezer space, while the West North Central and Pacific regions, combined, account for 28 percent. This leaves the other 5 geographic regions (30 States) with only 22 percent of the Nation's sharp freezer space.

The three main reasons for storing frozen foods in a particular location are: (1) Holding either at the packer's private warehouse or at a public warehouse in areas of production preparatory to shipping; (2) holding at in-transit points for rerouting purposes; and (3) storing for distribution at terminal points (includes storage of small amounts in rural and rural-urban areas). Therefore, warehouse space exists in an area according to the importance of that area in food production, the nature of the area as an in-transit storage center, and the size of population.

Table 13.--Gross sharp freezer space (0° F. and below) by regions for specified years, and percentage change 1939-47

Regions	1939	1941	1943	1945	1947	Change 1939-47
	<u>Mil.</u> <u>cu.ft.</u>	<u>Mil.</u> <u>cu.ft.</u>	<u>Mil.</u> <u>cu.ft.</u>	<u>Mil.</u> <u>cu.ft.</u>	<u>Mil.</u> <u>cu.ft.</u>	<u>Percent</u>
New England	7.7	7.6	8.2	8.8	7.0	- 9
Middle Atlantic	21.3	28.3	28.2	30.9	36.9	/ 73
East North Cen.	24.1	30.0	30.7	35.3	32.9	/ 37
West North Cen.	16.6	22.2	23.1	29.0	31.4	/ 90
South Atlantic	2.2	2.7	2.0	3.9	5.1	/ 132
East South Cen.	1.8	1.5	1.9	3.3	3.7	/ 106
West South Cen.	2.9	4.1	4.0	5.1	6.0	/ 107
Mountain	1.7	1.0	2.2	2.8	2.8	/ 65
Pacific	8.3	10.7	10.4	15.8	19.6	/ 148
U. S. total	86.6	108.1	110.7	134.9	145.4	/ 68

Four of the nine geographic regions, that is, the Middle Atlantic, East North Central, West North Central, and Pacific, have 78 percent of the sharp freezer space. These regions are also important areas of production and consumption. Figures 37 through 41, which show the production and storage of various frozen commodities by regions, give a description of the production-storage relationship for the United States. For the most part, the regions with the most storage space are in the areas of primary consumption, namely, the areas with the largest concentration of population. Figure 42 shows by regions how population is related to production and storage space. The East North Central and the West North Central regions are areas of considerable in-transit importance. The magnitude of these two areas as storage centers is also augmented by the fact that they are secondary producing and consuming regions. For example, in-transit storage occurs most frequently in the States immediately east and west of the Mississippi River. At the same time these areas produce for freezer storage large quantities of poultry, eggs, and meats, and smaller quantities of fruits and vegetables. Also, the population in these areas is relatively dense at some points and the storage of foods for distribution becomes an important function of warehousing.

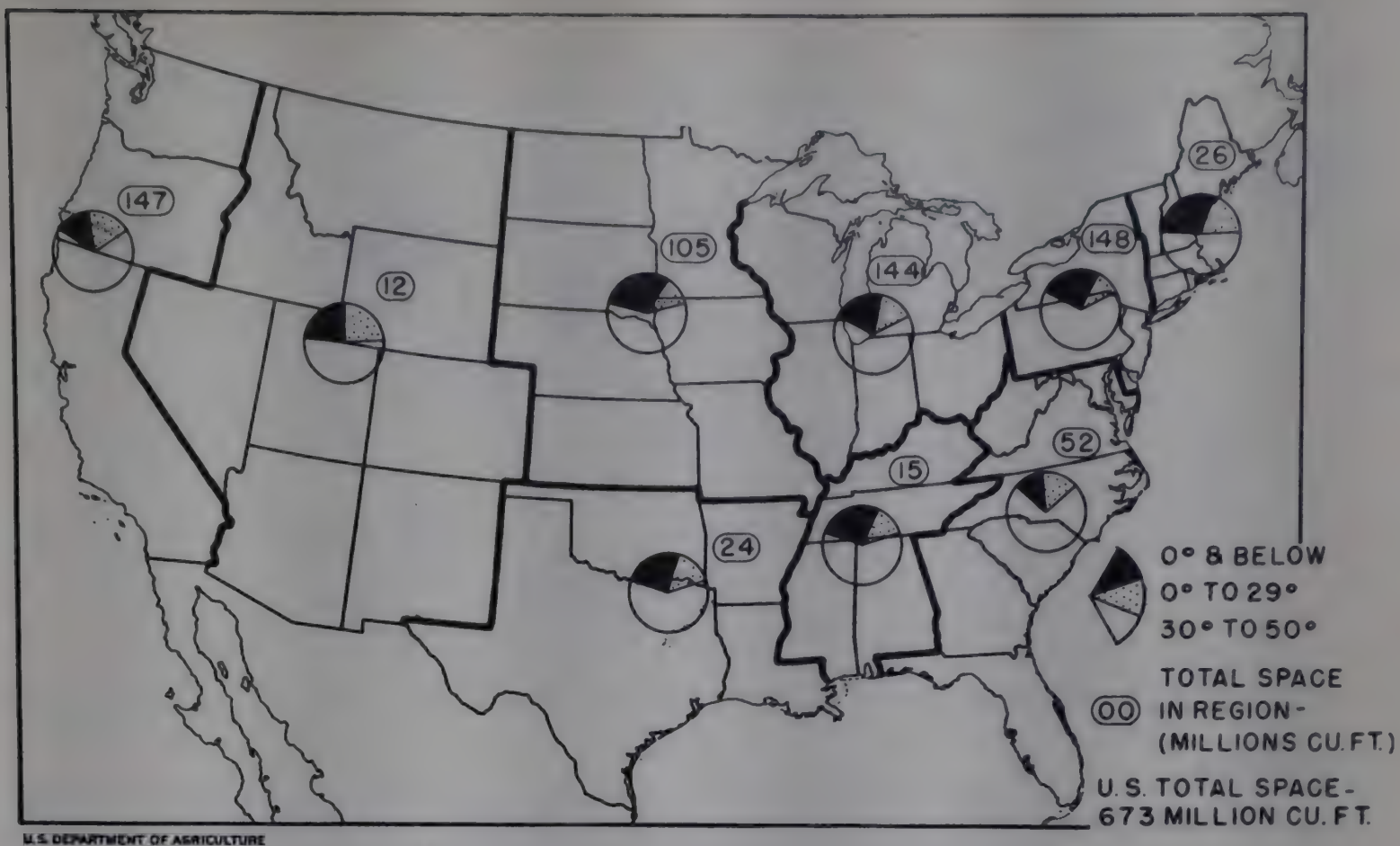
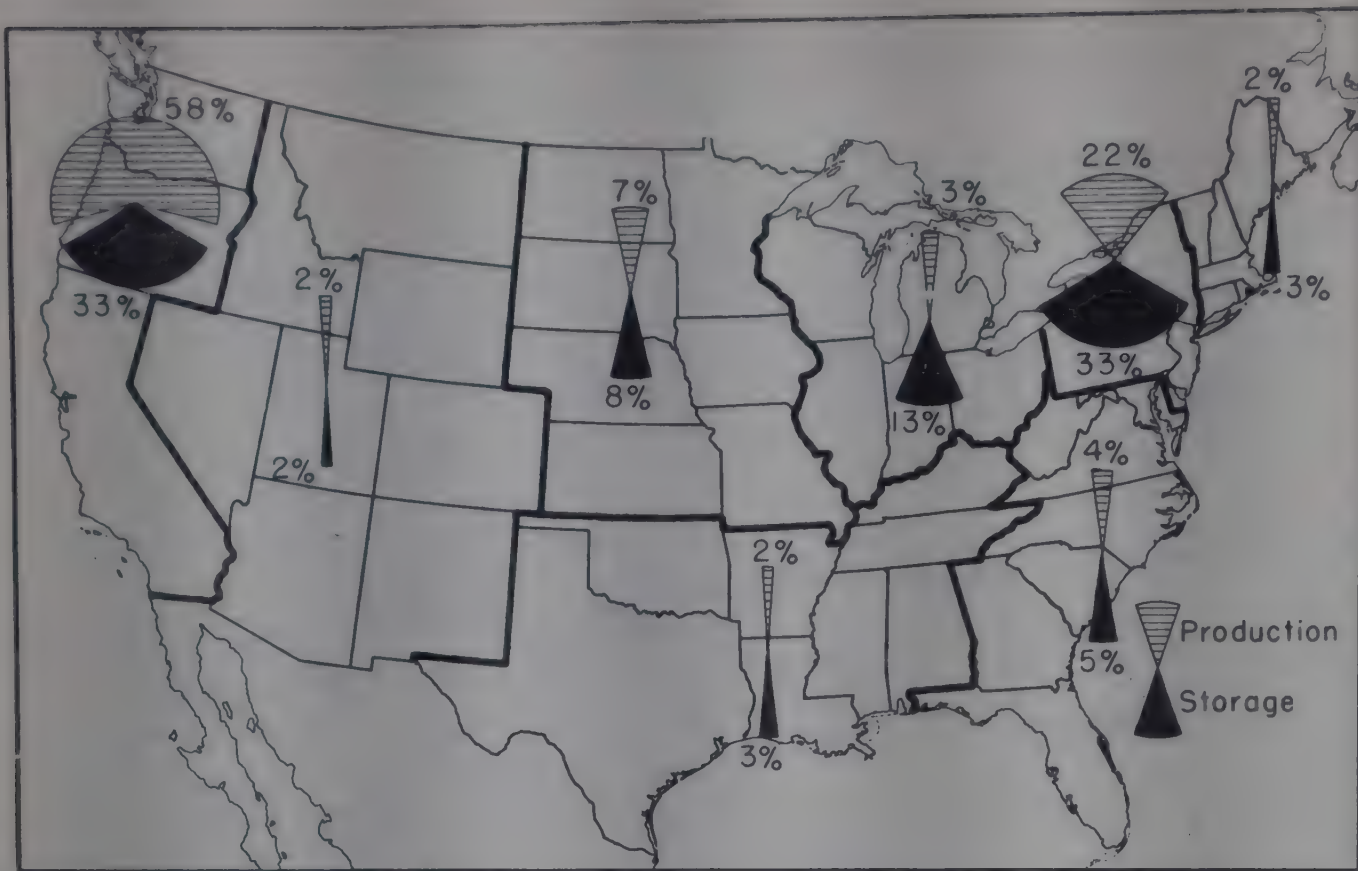


Figure 36.--Gross sharp freezer storage space as compared with cooler and regular freezer space in refrigerated warehouses, by regions, 1947.



Figure 37.--Production and peak storage holdings of frozen fruits, 1947 as a percentage of U.S. total.

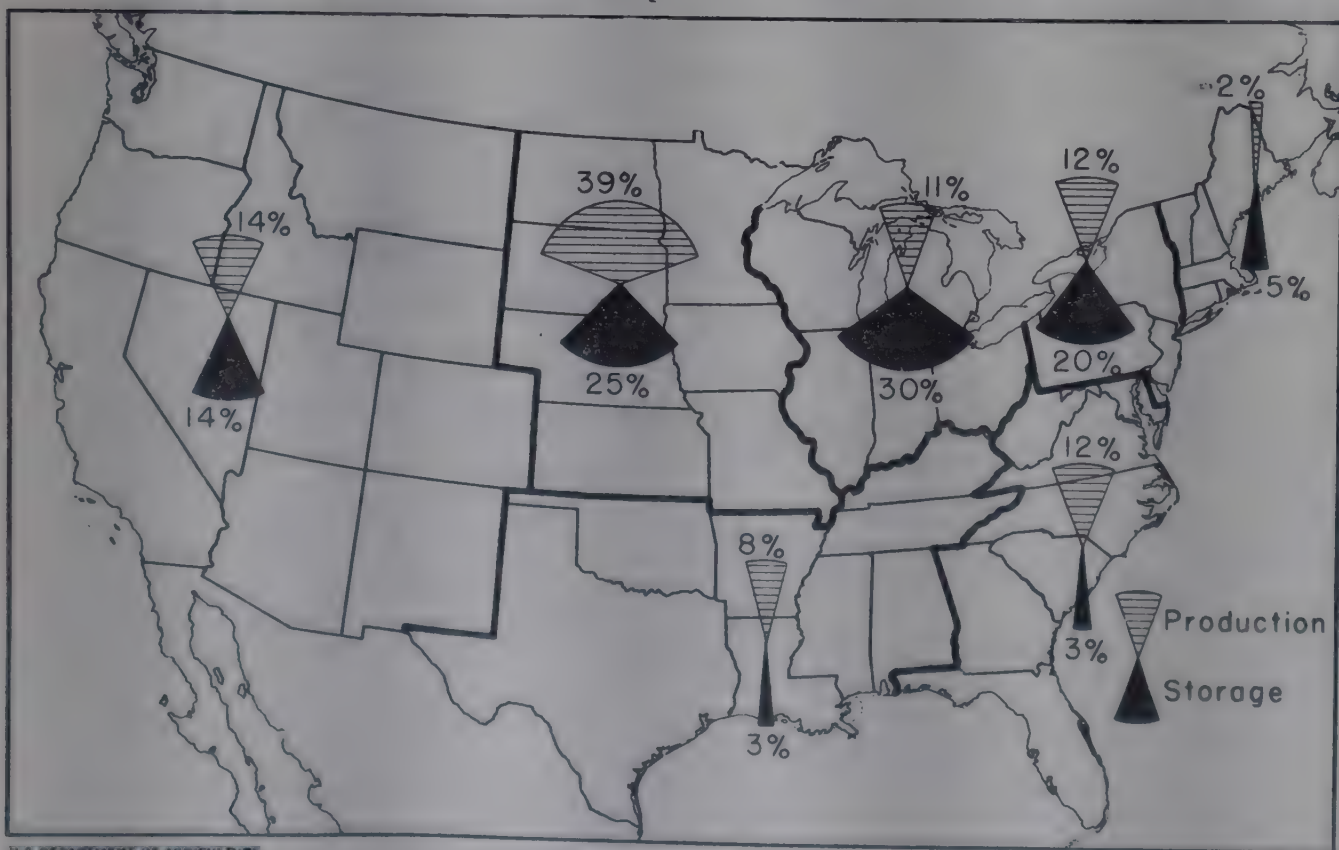
Source: Production is based on figures from the National Association of Frozen Food Packers and unpublished data, Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. Agr. Peak storage holdings represent United States total.



U.S. DEPARTMENT OF AGRICULTURE

Figure 38.--Production and peak storage holdings of frozen vegetables, 1947 as a percentage of U.S. total.

Source: Production is based on figures from the National Association of Frozen Food Packers and unpublished data, Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. Agr. Peak storage holdings represent United States total.



U.S. DEPARTMENT OF AGRICULTURE

Figure 39.--Production and peak storage holdings of frozen poultry, 1948 as a percentage of U.S. total.

Source: Production compiled from data furnished by Poultry Branch and from unpublished data, Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. Agr. Peak storage holdings represent United States total.

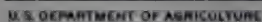


Figure 40.--Production and peak storage holdings of frozen fish, 1947,
as a percentage of U.S. total.

Source: Based on statistical reports by the Fish and Wildlife Service, U.S. Dept. Int. and on data from the Special Commodities Branch and the Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. Agr. Peak storage represents United States total.



Figure 41.--Production and peak storage holdings of frozen eggs, 1948,
as a percentage of U.S. total.

Source: Production based on data furnished by the Poultry Branch and from unpublished data, Marketing Facilities Branch, Production and Marketing Administration, U.S. Dept. Agr. Peak storage holdings represent United States total.

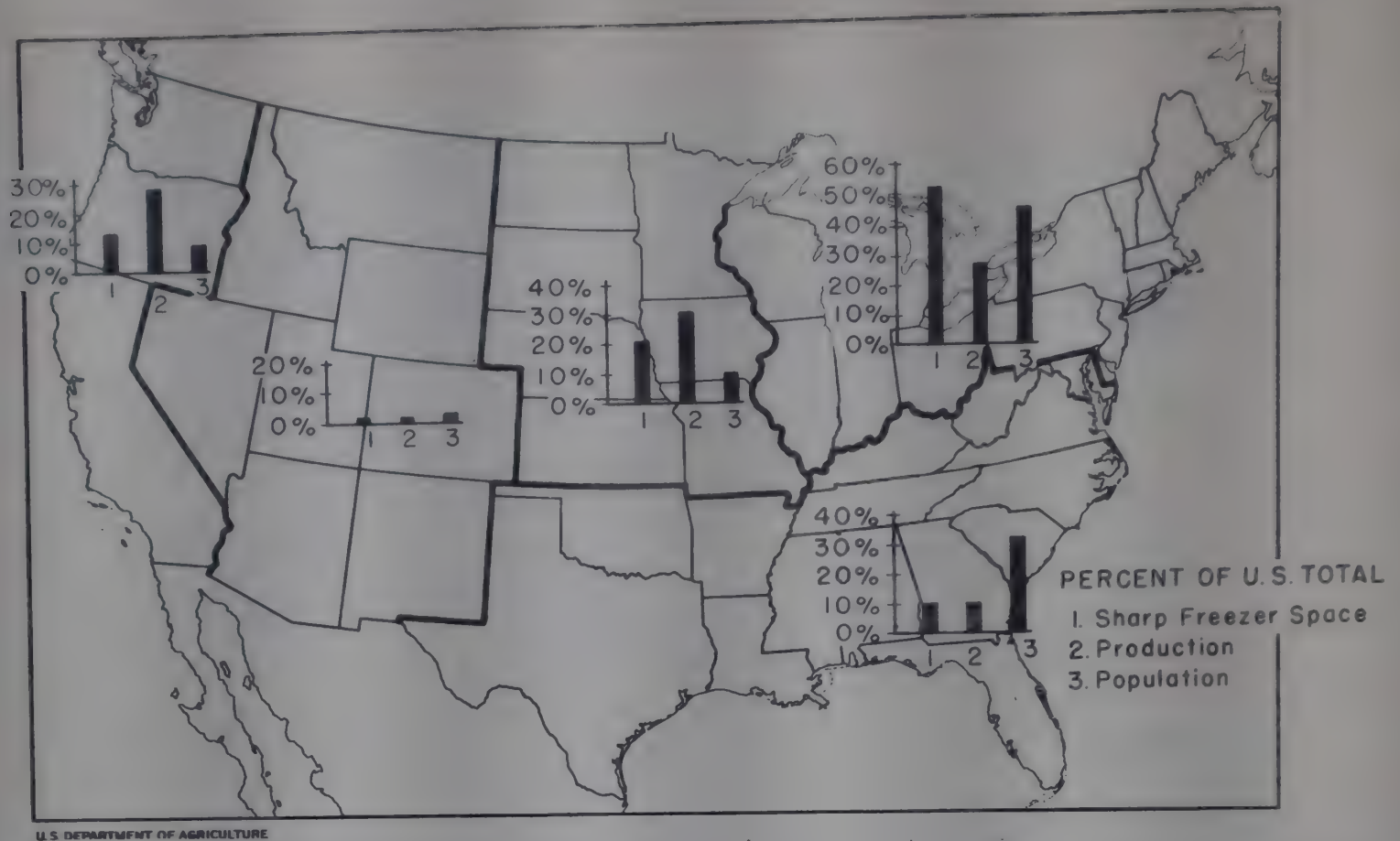


Figure 42.--Relation of warehouse sharp freezer space to frozen-food production and to population, by regions, 1947.

Source: Frozen-food production based on available figures and estimates. Population based on current estimates by U.S. Census Bureau.

The Southern and Mountain regions (consisting of one-half of the 48 States) represent about 36 percent of the Nation's population and have only about 11 percent of the country's total zero storage space. At the same time these two regions produce only 12 percent of the total frozen foods. As compared with other regions, the proportion of zero storage space is less in the Southern States because of a predominant rural population, a longer growing season, and lower per capita retail sales.^{11/} In the Mountain region, the scarcity of zero storage space is accounted for by the existence of a sparse and scattered population, with only a few large cities.

In considering the facilities for storing frozen foods in the 5 "rural" regions, the operation of frozen-food locker plants has great significance. The activities and functions of these locker plants minimize the need for regular refrigerated warehouses. At present the development of the locker plant centers around the processing and freezing of locally grown supplies

^{11/} Lower per capita sales is reflected through the longer growing season and the consequent greater utilization of home-grown products. The 1945 census gives per capita consumption retail sales for food products at \$89 for the East South Central States as compared with \$205 for the New England States.

for storage and consumption within the immediate area. Through servicing more than 3 million families, America's 11,000 locker plants are potentially important distributing agencies, offering at least short-term storage for commercial frozen foods. 12/

The length of time that frozen foods are stored at warehouses in the packing, in-transit, and terminal areas depends mainly on the following factors:

1. The amount of available zero storage space at the packer's warehouse as related to his volume of production.--Usually the limited storage space in a packing area makes it necessary for frozen foods to be shipped to in-transit or terminal warehouses as the packing operation progresses. Because of the reluctance of packers to build large storage facilities, they can only store small amounts of frozen foods. The short-term storage at the packer's warehouse is usually for that interval between the removal of the commodities from the freezer equipment and the loading out onto transportation facilities once the desired lots have been accumulated for shipment.

2. Availability of space in in-transit and terminal warehouses.--If freezer storage space is filled to capacity at in-transit points and at terminal warehouses, then shipments from the packer warehouse will of necessity be delayed until appropriate space becomes available. For the most part, packers make arrangements in advance with warehouses for the storage of large quantities, but even the best planning cannot always assure the availability of storage space when and where needed.

In recent years, freezer storage space has been well filled during the fall months in many sections of the country. Although the shipment of frozen foods from packing plants has not been hampered very much by a scarcity of freezer space in areas where foods are destined for consumption or in-transit storage, the problem does call for careful consideration in future planning.

3. Intensity of the demand for frozen foods.--Naturally, the factor of demand constitutes a continuous problem in the removal of frozen foods from the packer's premises and into storage warehouses along the marketing channel. Items with a strong demand will move without much difficulty through warehouse facilities and into the custody of the wholesale distributor at terminal distribution points, whereas, an item that becomes a "slow mover" on the retail market, can be expected to glut some storage facilities, and thus occupy space that could be used advantageously by items that are in high demand.

4. Sales and purchasing policy of packers and distributors.--The sales policies of packers and the purchasing policies of distributors influence the location of storage stocks of frozen foods. For example, a packer may freeze foods for a distributor who will take possession of

12/ Based on Frozen Food Locker Plants in the United States, eleventh annual count, July 1948, K. F. Warner, U. S. Dept. Agr., Ext. Ser.

the merchandise upon the completion of the freezing operation. On the other hand, a packer-distributor may freeze foods and store them in a local warehouse and make shipments to consuming areas as needed.

In planning long-term storage for large quantities of frozen foods, first consideration should be given to the geographic location of the warehouse in respect to the producing areas and the areas of consumption to be served. Many frozen foods are today marketed from producer to wholesaler haphazardly through several different warehouses. An orderly system embodying the selecting of a warehouse for long-term storage at a proper location could result in considerably less handling.

Commodities going to terminal areas frequently have to be reshipped at a later date to some other market, in order to satisfy demand at all points. Foods stored at in-transit places are stored with the idea of taking advantage of the "through" freight rate and at the same time using the in-transit warehouses as a pivot point for assembling carloads of mixed frozen-food items to ship to distributors. Storing in in-transit warehouses usually affords the shipper greater flexibility because of the ease in diverting frozen-food shipments to any desirable place. Usually the closer this in-transit storage is done to the packer, the greater the flexibility, but due regard has to be given to the importance of using the warehouse as an assembly point for various items. When a distributor who operates several outlets gets his vegetables from one section of the country, his fruits from another, and his poultry and fish from still another, it is desirable to assemble them some place in mixed loads for further distribution. Under such conditions the selection of a warehouse becomes a matter of making the most suitable choice to fit the particular situation. The selection of a centralized storage point by a company with several wholesale outlets could mean the elimination of much cross-hauling caused by local shortages and surpluses.

Although in the past, storage facilities were constructed primarily in the areas of consumption, in more recent years the trend has been toward construction in the producing and in-transit areas. In this respect, table 13 (page 62) shows that the Pacific region, which is a prominent producer of frozen fruits and vegetables, had the greatest increase of freezer space over the 9-year period, 1939-47.

The warehouses that have been constructed in recent years seem to have gained several economic advantages over established warehouses. Two of these advantages are: (1) Using modern construction methods and designs which permit installation and use of improved handling equipment; (2) in the case of in-transit warehouses, building them at points which give them greatest advantages in handling.

Seasonal Movement of Frozen Foods Through Warehouse Storage

Since frozen-food production is essentially seasonal, it is only natural that the stocks of any one commodity are highest when the producing season for that commodity is near completion and are lowest just before the next harvest season arrives. As the producing season varies from one product to the other so does the into-storage and out-of-storage movement. However, it can generally be said that the heaviest in-movement

of fruits, vegetables, eggs, and fish occurs in the spring and summer and the heaviest in-movement of meats and poultry occurs in the fall and winter. The peak and low holdings of the total of all freezer items vary slightly from year to year but the in-movement usually begins in May or June and the out-movement in September or October (fig. 43). In 1947, at the termination of the general into-storage movement, the total amount of frozen foods (the seven main freezer items) totaled 1.6 billion pounds. When stocks were lowest they totaled 1.3 billion pounds.

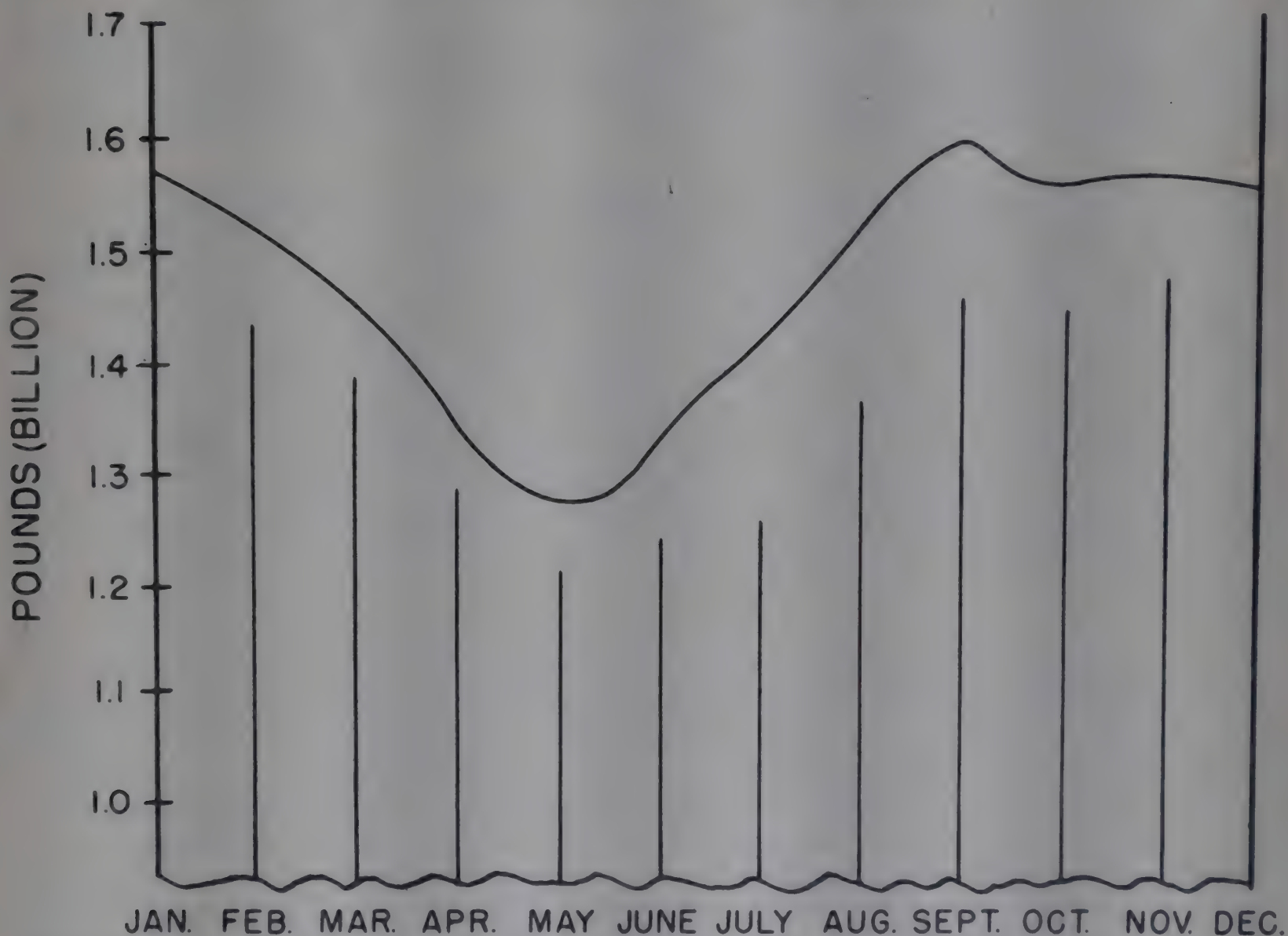


Figure 43.--Volume by weight of 7 main freezer commodities in storage each month, 5-year average 1944-48 (Includes fruits, vegetables, poultry, eggs, meat, dairy products (cream and butter), and fish).

Source: Figures for fish taken from Frozen Fish Reports, Fish and Wildlife Service, Dept. Int.

The storage of seven main freezer items had the following relationship when stocks were highest in 1947:

<u>Product</u>	<u>Percent</u>	<u>Product</u>	<u>Percent</u>
Fruits	25.0	Eggs	11.7
Vegetables	21.4	Meat	10.2
Poultry	17.1	Fish	7.4
		Dairy	7.2

As the general out-movement of freezer stocks terminated in 1947, and stocks were lowest, the following relationship existed between products:

<u>Product</u>	<u>Percent</u>	<u>Product</u>	<u>Percent</u>
Meat	25.8	Poultry	15.1
Fruits	23.2	Eggs	11.1
Vegetables	17.9	Fish	5.1
		Dairy	1.8

Meat moves into storage when other frozen-food items move out, thus explaining why a high percentage of frozen meats are in storage at the low all-product storage point.

In order to assure a continuous supply of frozen commodities on the market, some carry-over from year to year is desirable, but because of definite limits to the storage life of most frozen products, it is very important that these foods are put into consumer channels before their maximum storage time is reached and quality begins to drop. In years when carry-over stocks are excessive the foods are moved into the market by a downward pricing policy. If the effort of moving surplus stocks allows the products to go beyond their ordinary storage life, then the problem not only becomes magnified many times but the movement of low-quality merchandise on the market hurts the salability of the new pack. Table 2 (page 6) shows the storage life of frozen products at various temperatures.

Frozen fruits.--The low in freezer holdings of fruits, reported at 278 million pounds in 1946 and 318 million pounds in 1947, usually occurs in June, which is about the time of the year that the over-all fruit-packing season is gathering momentum (fig. 44). The peak storage occurs almost every year in November and in 1947 there were 406 million pounds stored in that month. Except for berries, which are frozen mainly between January and May, storage holdings in June indicate the amount of fruits carried over from the previous year's pack. The storage figures over the past few years reveal that the percentage of frozen fruits stored in packing areas is somewhat greater during the peak storage period than at the low storage point.

Frozen vegetables.--The seasonal storage of frozen vegetables follows the same general fluctuations as frozen fruits. The low usually occurs somewhere between May and June and the peak sometime from October to December. In 1947, the low storage occurred in June and amounted to 231 million pounds. The peak was in October, when there were 353 million pounds in storage. The in-movement of vegetables differs somewhat from fruits in that several important vegetables, such as broccoli and cauliflower, are produced in the winter, whereas, about the only important winter production of fruits is citrus. Figure 45 shows the seasonal movement of vegetables in freezer storage by months - 1944-48 average.

Frozen poultry.--The low storage for frozen poultry usually exists in June, July, or August, and amounts to downward of 175 million pounds (fig. 46). The peak storage point occurs in December, January, or February,

with upward of 275 million pounds being held. The initial into-storage movement begins with broilers in May, fryers in September, roasters in September and October, fowl in October, and turkeys in November. Of course, some of these birds held in freezer storage are of the New York dressed (or hard chilled) type. In fact, only a small part of the frozen poultry reported in storage is sold eventually as frozen packaged poultry. The extent as well as the initial date of the into-storage movement varies with the geographical regions of production. These production regions are widely distributed throughout the United States. As can be seen by figure 39, page 64, the heaviest production is in the North Central regions. Storage volume is also large in these regions, but a large amount of the frozen poultry is shipped out during the early part of the heavy producing season for storage in the areas of consumption.

Frozen meats.--As pointed out in a previous chapter, only a very small amount of meat in freezer storage is marketed in prepackaged frozen form. Most of the stocks consist of carcasses and meat parts that are stored for use during periods of shortage or for reasons of monetary speculation. Although the seasonal movement of meats marketed to consumers and restaurants in the frozen state does not necessarily follow a definite pattern, the 1944-48 average showed a range in the amounts in all frozen meats stored in warehouses from a low of 204 million pounds in November to a high of 426 million pounds in March. Of these amounts, beef and pork constituted about 90 percent. The remaining 10 percent consisted mostly of lamb, mutton, and veal. Figure 47 shows the in- and out-movement of all meats - 1944-48. Beef begins an into-storage movement in September, continuing until the peak is reached and an out-movement begins in March. The movement of pork is somewhat similar to beef. The in-movement begins in November and terminates in March, at which time the net out-movement begins. A slow into-storage movement of lamb and mutton commences about September and continues until about January or February. The out-movement is equally as slow and spans from January or February until September. Veal moves into storage about July and continues until about January, when the out-movement begins. The principal meat-packing region, the North Central States, stores about 70 percent of the Nation's frozen meats during the annual peak storage period and about 60 percent when stocks are lowest. This high percentage of frozen meats held in producing areas is in direct contrast to the holding of frozen fruits and vegetables primarily in consuming areas. These facts and figures do not take into consideration the tremendous amounts of meat processed and stored at frozen-food locker plants.

Frozen fishery products.--Although frozen fishery products are coming into storage the year around, the low in storage stocks is usually reached in April or May and the high in December (fig. 48). In 1948, the low holdings amounted to 68 million pounds while the peak was 158 million pounds. Most of the total fishery products in storage are marketed in the frozen form.

Frozen eggs.--Frozen eggs usually start an into-storage movement in the early spring, reach the annual peak, and start their out-movement in midsummer (fig. 49). According to the 1944-48 average, the annual low in storage was 86 million pounds and occurred in March; the peak storage was 298 million pounds and occurred in August. There is no significant

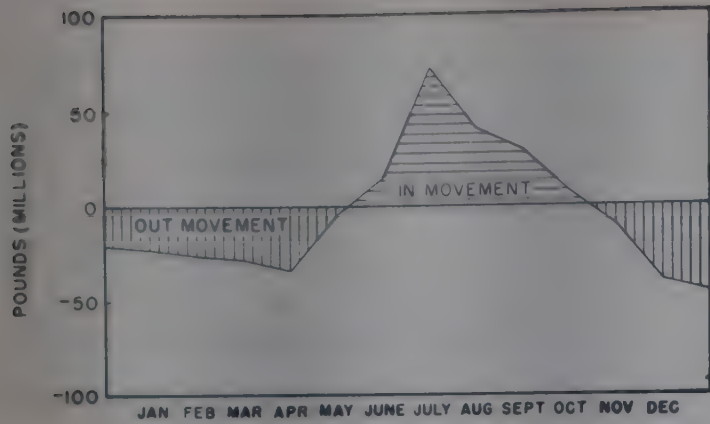


Figure 44.--Net movement of frozen fruits into and out of storage - 5-year average (1944 - 48).

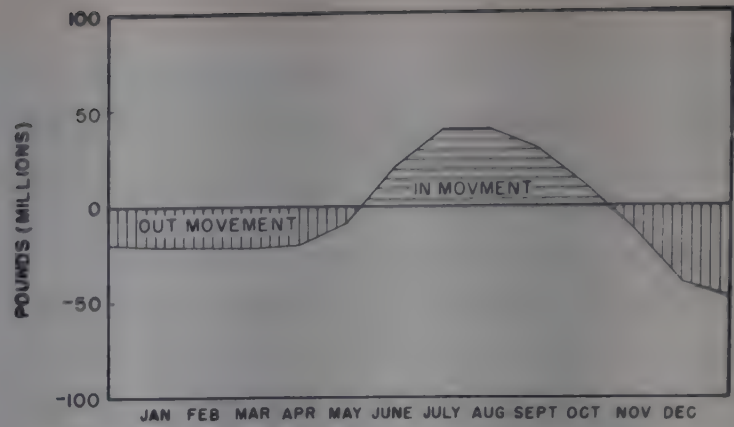


Figure 45.--Net movement of frozen vegetables into and out of storage - 5-year average (1944 - 48).

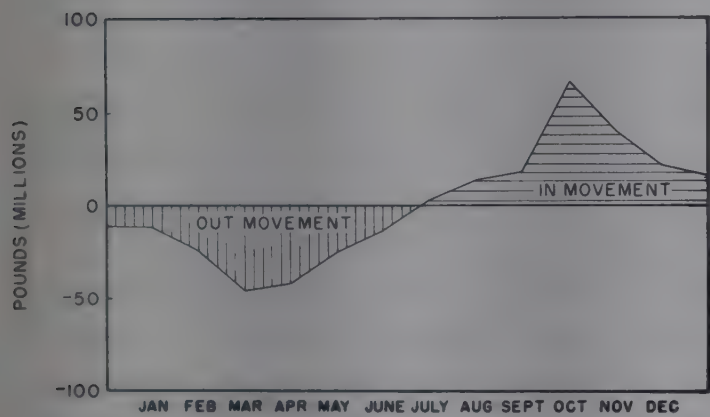


Figure 46.--Net movement of frozen poultry into and out of storage - 5-year average (1944 - 48).

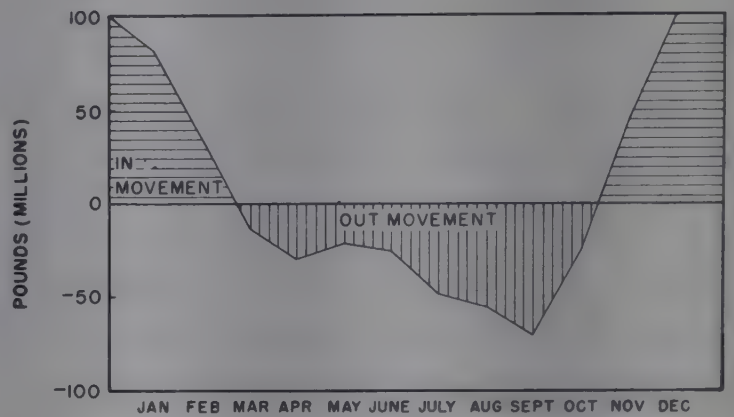


Figure 47.--Net movement of frozen meats into and out of storage - 5-year average (1944 - 48).

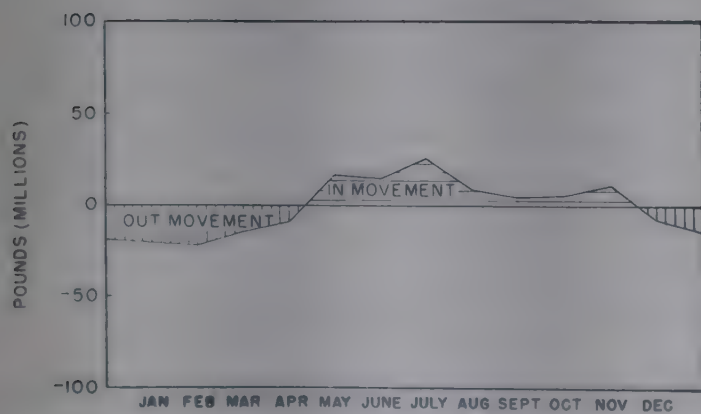


Figure 48.--Net movement of frozen fish into and out of storage - 1948.

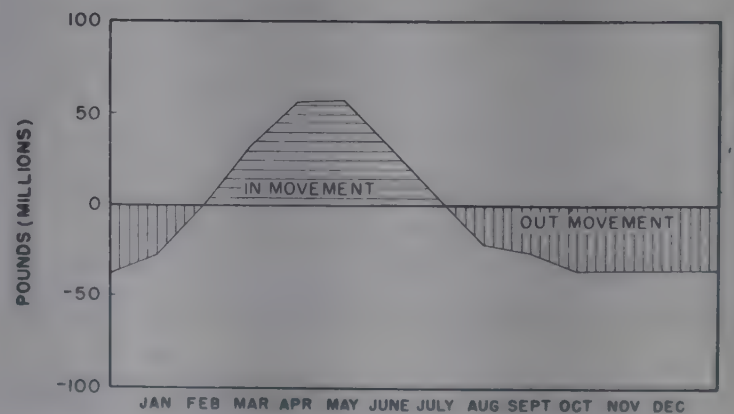


Figure 49.--Net movement of frozen eggs into and out of storage - 5-year average (1944 - 48).

difference in the percentage stored in the producing area during the production season as compared with the nonproduction season.

Frozen dairy products.--Creamery butter and plastic and fluid cream have an into-storage movement beginning in the late spring and reaching a peak in the late summer of early fall. The 1943-47 monthly average for creamery butter showed a low of 30 million pounds in April and a high of 150 million pounds in September. By the same token, the storage of frozen cream, both plastic and fluid, amounted to 12 million pounds in April, the low month, and 60 million pounds in September, the high storage month. These figures do not include the small amount of ice cream that is held in general storage in public refrigerated warehouses.

Frozen specialty items.--Frozen specialty items refer mainly to pre-cooked and prepared dishes, such as frozen meals, frozen french-fried potatoes, and frozen uncooked pies and cakes. There are no data available that show the seasonal storage movement of these specialty items, but the nature of the production of most of them would indicate no special pattern of movement.

Storage in Public and Private Warehouses

A public refrigerated warehouse is generally defined as an artificially cooled storage facility the operator of which is engaged in storing food commodities requiring refrigeration for others for pay, whereas the operator of a private warehouse uses his storage to facilitate his main function as a producer, processor, or distributor but does not store commodities for others for pay. There are some warehouses that are regarded as semiprivate warehouses. Such facilities are in effect private warehouses that have some space used to store commodities for others for pay.

About 85 percent of the long-term storage of frozen foods is done in public refrigerated warehouses. Although only a few packers and distributors have gone into long-term warehousing, more and more of these firms are increasing the amount of short-term storage facilities they have at their plants. A number of small packers have to rely entirely on public warehouses for freezing as well as storing. Similarly there are packers who have freezing facilities at their plants, but their short-term storage space is so limited that the frozen product has to be taken to the local public warehouse when it is removed from the freezing equipment.

The volume of business of frozen-food wholesale distributors, in most cases, has not been large enough to justify maintaining a facility to take care of all their storage. Although many distributors use private space for short-term storage, there are only a few who use private space for long-term storage. (See fig. 35.) The survey of 315 wholesalers which was conducted in 1947-48, showed that 84 percent of them are dependent on the public warehouse for long-term storage.

Some of the advantages of long-term storage in public warehouses are listed below:

1. Storage space exists in large amounts especially in important consumer and in-transit areas.

2. The operation of refrigerated warehouses requires a special skill and through many years of operation most public warehousemen have acquired valuable experience.
3. The public refrigerated warehouse is an established institution embedded in the routine channel of marketing perishables.
4. It is usually easier for the owner of the foods to borrow money on his commodities in storage if he has public warehouse receipts as collateral.
5. The public warehouseman is not limited to storing only frozen foods; therefore, he is in a position to have a high degree of space occupancy the year round and can thus realize economies in operation.

Following are some of the advantages of long-term storage in packers' warehouses:

1. Affords the packers an opportunity to exercise closer supervision of storage methods and other storage conditions that affect the quality of products.
2. Offers the packers longer direct control of goods for advantage in market price.
3. Because a private warehouse assures the packer of a definite amount of storage space, he will be in a good position to plan his operations on the basis of orders for "future" deliveries.
4. In many cases, storing at a packer's warehouse can shorten the marketing channel by enabling shipments to be made directly from the packer to the distributor's terminal warehouse.

Long-term storage at the wholesalers' private warehouses have advantages as indicated below:

1. The distributor can exercise close supervision of the storage of his own product.
2. Such storage allows for greater control over the inventory of goods, which in turn offers more flexibility in ordering from packers and brokers and taking orders from customers.
3. It permits self-performance of desired services, such as reconditioning, inspection, and sampling.
4. The distributor can arrange the facilities so as to realize maximum handling efficiency.
5. It reduces the amount of handling required by decreasing the number of facilities through which the product must pass.

The main disadvantage of performing long-term storage at the packer's private warehouse is that in seasons of production a large amount of space would be necessary, whereas, in seasons of off-production less space would be required. The maintenance cost of a facility large enough to accommodate most of the packer's volume of production would be almost prohibitive for short seasons of operation.

The frozen-food wholesaler likewise faces disadvantages in operating his private warehouse. He, too, has the disadvantage of seasonal storage as well as the difficulties involved in financing. A distributor will probably be justified in maintaining his own warehouse whenever year-round occupancy can be kept up to a profitable level and whenever his cost of handling is sufficiently reduced to give him an advantage over storing in the local or in-transit public warehouse.

A system that would perhaps be most efficient, from the standpoint of the wholesaler, would be for him to have facilities for most of his long-term storage at his wholesale plant; whether at a public or private warehouse. This would, of course, decrease cartage fees from one facility to another, and at the same time give the distributor some supervision over the commodities he owns. Yet, in some terminal points where the wholesaler cannot get economical facilities at the local public warehouse, he could probably benefit by storing at an in-transit point in a public warehouse and having a private plant with short-term storage for distributing his foods. This arrangement would be favorable under circumstances where the in-transit storage warehouse was in a position to grant low storage rates.

Warehouse Tariffs

The warehousing of frozen foods differs from production and wholesaling in that it is a service function. This is especially true because most storage is done at public warehouses where many services are performed for persons engaged in production and distribution. As a return for services rendered each warehouse assesses fees which are commonly known to the trade as tariffs. These charges vary in accordance with the following factors: (1) Types of commodities stored; (2) types of temperature furnished (zero, regular freezer); (3) size of containers; (4) weight of commodity; (5) density of commodity; (6) length of the storage period; (7) type and extent of additional services; and (8) cost of operating, including labor cost, real estate values, and type of equipment used.

Most of the warehouse services applicable to frozen foods are listed below. Although they are generally performed as described, there are some instances where the pattern does not conform to set procedures.

Storage.--Storage rates vary considerably from warehouse to warehouse. They are usually assessed on a monthly basis with a fraction of a month counting as a whole month unless special arrangements are made. There are minimum charges for small lots.

The rates for most frozen foods are based on a hundredweight. Heavy containers, such as barrels, usually have a higher rate per hundredweight

than smaller containers. Also, the less dense the package the higher the rate when calculated on a weight basis. Each contingent of frozen foods, which when received has a separate identity, is referred to as a lot. For rate-making purposes the weight divisions of lots are bracketed and usually run in multiples of 5,000. For example, lots of less than 5,000 pounds will be given a certain rate, lots over 5,000 and less than 10,000 pounds will be given a lower rate, etc. Table 14 shows some general rate figures for the handling and storage of selected frozen foods.

Table 14.--General warehouse charges for the handling and storing of selected frozen foods, 1947 ^{1/} (Based on rates for carload lots)

Commodity	: Charges per cwt. : : for handling : : <u>Dollars</u> :	: Monthly storage : : rate per cwt. : : <u>Dollars</u> :	: Cost per cwt. of : storage for : one year ^{2/} : <u>Dollars</u> :
Fruits	: 0.17 :	: 0.18 :	: 2.33 :
Vegetables	: .17 :	: .18 :	: 2.33 :
Cream	: .19 :	: .22 :	: 2.83 :
Eggs	: .12 :	: .14 :	: 1.80 :
Poultry	: .23 :	: .25 :	: 3.23 :
Meat	: .18 :	: .20 :	: 2.58 :

^{1/} Handling and storage charges per cwt. based on unweighted averages of warehouses in New York, Chicago, Denver, and New Orleans.

^{2/} Computed on basis of only one handling charge and not considering other charges that would occur. The figures are derived by multiplying the monthly storage rate by 12 and adding the cost of handling.

Handling in and out.--The first month's storage fee for any commodity is higher than for the subsequent months. This is because the cost of handling the commodities into and out of the warehouse is added to the storage rate. This handling rate covers the unloading and loading of rail cars but usually does not include similar services for trucks. They are assessed on a hundredweight basis and are scaled in accordance with the storage rates. Lots are moved in and out of storage as a unit and the breaking of lots for delivery purposes carries an extra delivery service charge. When it is necessary to move merchandise that is not going into storage in order to get to the food that is to be stored, a charge is assessed the storer according to the man-hours required to perform the extra handling. When a customer requests the movement of goods from one room to another, that is, cooler to freezer, the charges are assessed the storer at about one-half the basic handling rate. The handling of frozen foods across the warehouse platform from a common carrier to a private truck with warehouse labor and equipment is usually done at the same fee as for handling into and out of storage.

Freezing.--If the product received at the warehouse is unfrozen but is to be frozen, an additional charge is made for the freezing process. A higher per-hundredweight charge is assessed for quick-freezing (at sub-zero temperatures) than for regular freezing. The reason for this is that extra refrigeration is required for the quick-freezing process and also there is a need for special piling and spreading.

Deliveries.--There are two types of deliveries performed by warehouses. One is the delivery of the foods from the freezer storage room to the loading zone at the warehouse, and the other is the delivery of the merchandise by truck from the warehouse to other designated places. In regard to the latter type of delivery, the survey found that only in one instance was a warehouseman providing for cartage of frozen foods.

The delivery of frozen foods from the freezer storage room to the loading zone at the warehouse is usually covered by the in-and-out handling charge, but additional charges are made for special deliveries to the platform of a part of a lot. This is commonly called a withdrawal fee, and in the past few years its assessment has become common practice throughout the United States. The amount of this fee is commonly 50 cents for each withdrawal, but some warehouses charge 50 cents for each withdrawal from each lot in storage. On the other hand, a few warehouses do not assess the withdrawal fee at all. In the survey, about 90 percent of the wholesalers reported paying withdrawal fees. Some members of both the warehouse and frozen-food industries maintain that this fee is essential to cover the handling cost of small deliveries to the platform and that the fee tends to prevent a few distributors from using the warehouse as a facility for carrying on their wholesale operation without leasing space for this purpose. Before the fee was assessed, many distributors would pick up their daily orders each morning at the warehouse and, in addition, would return several times each day as sales were made, to withdraw small amounts of frozen foods. The man-hours involved in making such deliveries to the warehouse platform naturally had to be covered by some kind of additional charge. The withdrawal fee also had the effect of prohibiting wholesalers from using the warehouse as a "frozen-food checking station." Although this fee has some merit, it has probably encouraged the construction of small holding rooms on the premises of some wholesalers and even caused others to give up frozen food distribution.

Space rental in warehouses.--In the production areas frozen-food packers often rent large quantities of freezer storage space from public warehouses. At the terminal warehouses smaller amounts of freezer space are often rented to distributors. This rented space is commonly charged for on a cubic-foot basis; zero space rents for a higher fee than regular freezer space. There is usually a minimum charge for small units of space.

Pipe-line refrigeration.--Often refrigeration is made available to establishments located near the public refrigerated warehouse. The refrigerant is piped from the engine room of the warehouse to a user's premises. As figure 35 (page 60) shows, 10 percent of the frozen-food distributors surveyed who operate from independent facilities use a refrigerant that is piped from the nearby public warehouse. The charge for this refrigeration is on the basis of the length and size of the pipe used. Generally the

rate of charge decreases as the number of feet used by an establishment increases. For users of only small footage there is a minimum charge, and likewise there is frequently a maximum charge favoring the establishments that have large footage. From the wholesaler's viewpoint, there are several advantages to this refrigerant rental system over a distributor-owned and -operated system. The main advantage lies in the decreased chances for failure of the system, because the central plant at the warehouse has 24-hour supervision by a trained technician. The main disadvantage is the higher freezer temperature that frequently results when brine is piped several hundred feet away from the warehouse. Then too, with the rental system the user does not have as close supervision over the desired temperatures as he probably would have if he had his own unit. The total cost of the rented refrigerant varies under different circumstances, and it is therefore difficult without further study to say which of the two systems is the most economical.

Issuance of warehouse receipts.--When a company stores food at a public warehouse, the warehouseman issues a receipt to the storer which identifies the commodities stored. These receipts are issued as either negotiable or nonnegotiable, depending on the desire of the customer. Under various conditions the negotiable receipt may be used by the storer as collateral to borrow money on his goods. The loans are usually made by banks and other lending institutions. These loans are made with the stipulation that the warehouse will permit the storer to withdraw from storage only that part of the merchandise on which he has repaid his loan. These original warehouse receipts are generally issued without charge, but the issuance of any subsequent receipts on the same lot usually carries a small fee.

Insurance.--Public refrigerated warehouses will insure or cause to have insured any goods that the customer desires to have protected in this manner. Insurance coverage is usually necessary before a storer can borrow money on the merchandise. Most warehouses offer a scale of insurance rates, the amount of the rate depending on the extent of the coverage. Meats, fish, and poultry carry a slightly higher rate than other frozen foods. The insurance is issued at the storer's expense, and the charges are in addition to other charges normally assessed.

Other services.--There are 25 or 30 basic services that the public refrigerated warehouse can perform for the frozen-food storer, but the services discussed above are the most common for which there is a storage charge. There are other minor services, however, that are generally charged for on a man-hour basis. These services are performed whenever they are obviously necessary or when requested by the storer. In some instances charges are not made when the task is small and the storer is a good customer. Some of the most common of the miscellaneous services are: (1) Repacking; (2) reconditioning; (3) weighing; (4) sampling; (5) reconditioning; (6) inspecting; (7) cash advances for C.O.D. express, etc.; (8) furnishing of dock space for loading and unloading vehicles; (9) special clerical services; (10) inventory reports; (11) marking containers; and (12) providing delivery notices.

Handling Frozen Food at the Refrigerated Warehouse

Importance of efficient handling.--The fact that there is a relatively high fee for moving frozen foods into and out of storage is indicative of the importance of efficient handling. The movement of a unit load of frozen foods to and from a pile in storage and to and from the loading platform constitutes an operation that if inefficiently done can add materially to the marketing cost of the products. It seems a simple matter to unload a rail car or truck, convey the frozen foods to a pile in storage, and later return them to the loading zone for hauling away in a vehicle. And if all the factors involved are favorable to efficient operation, the movement of the foods can be almost as simple as it seems. But in most warehouses throughout the country, the conditions are not ideal for handling frozen foods, and the problem becomes one of using the best-known practices to suit the particular situation. Most of the warehouses in the country were built prior to the commercial freezing of foods on a large scale, and the conditions under which they operated at that time called for different techniques than are necessary today. New and improved equipment has been developed that operates quite efficiently in new warehouses but is not adapted to efficient operation in many of the older warehouses.

In moving frozen foods into and out of the warehouse storage room, the objective is to complete the operation in the least possible time and to do it at as low a cost as possible. Some of the factors that influence the length of time that the products are out of refrigeration and that affect the efficiency of the operation are: (1) Warehouse design; (2) adaptability of equipment; (3) methods of piling and unpling; and (4) withdrawal procedures.

Warehouse design.--Warehouses are generally classified as to design according to whether they are single story or multiple story. Most of the larger warehouses in operation today are of the multiple-story design, but in recent years several large single-story warehouses have been constructed (fig. 50). Although advantages and disadvantages of each are subjects of wide controversy, the main advantage of the multiple-story warehouse is that it occupies less ground space, and this is a big factor in metropolitan areas where real estate values are high. The principal advantage of the single-story warehouse perhaps lies in its adaptability to the use of modern handling methods and thus provides an opportunity for high efficiency in handling frozen foods into and out of storage.

Warehouses that are so designed as to have inadequate space at the loading dock for unloading or loading rail cars and trucks are likely to find that congestion at certain hours of operation causes inefficient use of labor and equipment. Also, the location of loading zones in relation to the storage rooms can be cause for cumbersome handling in moving merchandise.

Adaptability of equipment.--The equipment used in a warehouse has to be suitable to that warehouse's lay-out. A piece of equipment might be used with utmost efficiency in one warehouse and yet be entirely inadequate in another. In a single-story warehouse where the floor can stand great

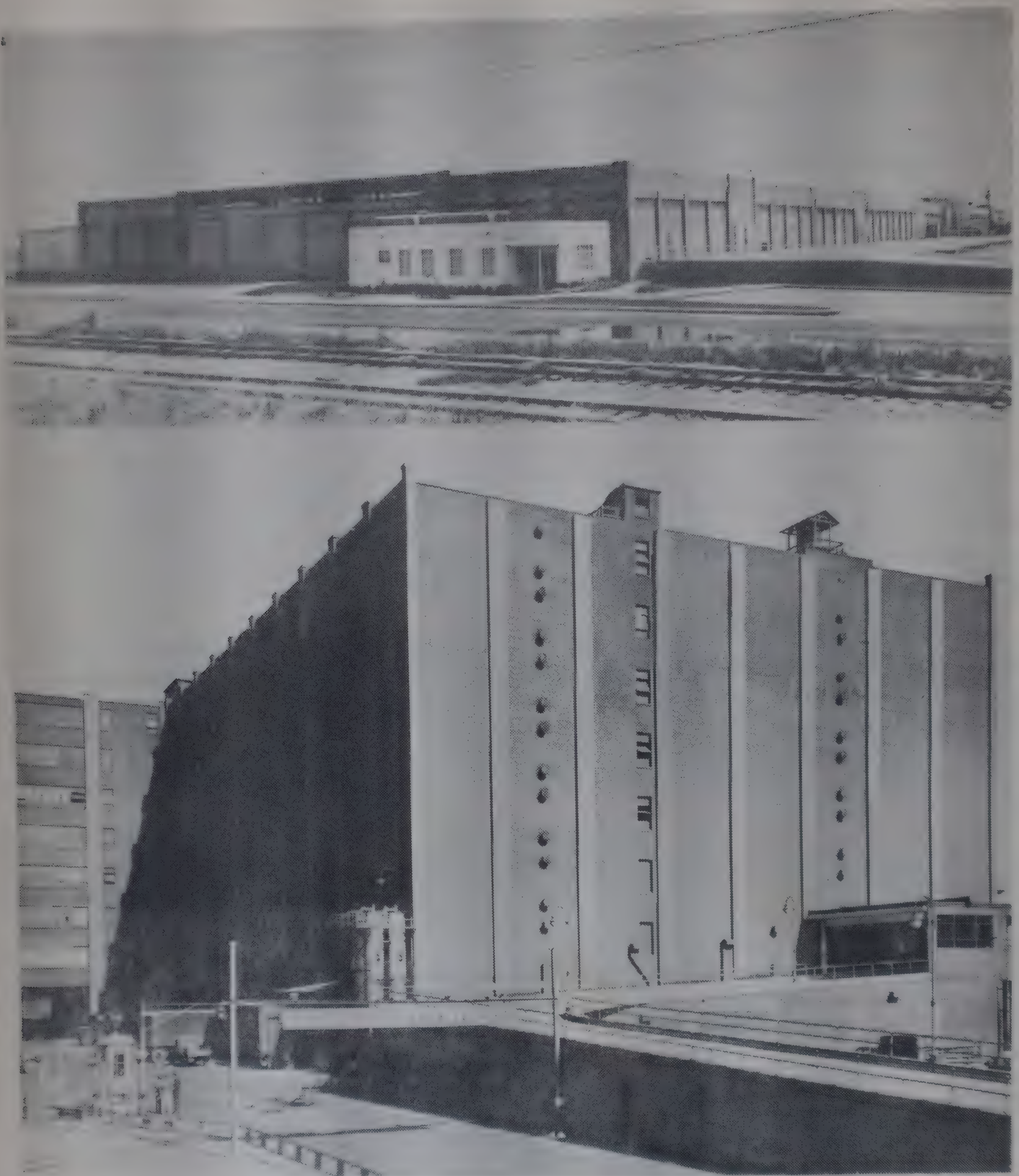


Figure 50.--Refrigerated warehouses are constructed as multi- and single-storied buildings. Single-storied buildings (top) are an innovation in warehouse design and have been constructed mostly in spacious-producing or in-transit storage areas. The multi-storied structures (bottom) are most common in large metropolitan areas where ground space is at a premium.

weight and the ceilings are high, a heavy fork-lift truck may be used with a palletized operation, whereas, in a multiple-story warehouse where the capacity of the floor and elevators are limited and where there is a low ceiling, heavy mechanized equipment may be entirely useless.

There are types of equipment that move merchandise by the direct use of manual labor, such as four- and six-wheel hand trucks. Then there are the conveyors that with the aid of manual labor in loading and unloading will move the frozen foods by gravity means. An example of this type is the gravity roller conveyor or the slide chute. Finally, there are conveyors that move frozen foods by mechanical means with very little or no physical pushing or carrying. The endless belt conveyor, the elevator, and the fork-lift truck are examples of this type of equipment. Rarely does one find a situation where one piece of equipment will perform all of the steps of unloading a carrier, moving the frozen foods into the pile in storage, and later returning the merchandise to the platform. In most warehouses, several different pieces of equipment are used in moving merchandise to and from the pile in storage. A successful handling operation requires the use of the right combination of equipment.

Methods of piling and unpling.--Proper piling is important in refrigerated warehouses for three reasons: (1) When a room is refrigerated, it is important for the sake of economy to use all available space. (2) Frozen foods require constant temperatures and controlled air circulation in accordance with the needs of the specific product. Piling too near the wall, floor, or ceiling, or piling unfrozen products too compactly can cause loss of quality. (3) Inefficient piling and unpling methods can add to the warehousing cost.

Although the conveying of merchandise by some form of equipment has been practiced since the beginning of the warehouse industry, the piling operation has almost always been done by hand. This hand-piling and unpling operation is one reason why the ceilings in warehouses were built only 10 or 12 feet from the floor. The piles could not be higher than the average-sized man could stack. In recent years, though, the palletized system has been developed by which whole tiers of merchandise are stacked by the use of a mechanical lift on a fork truck. Not only will these lifters stack hundreds of pounds at one lift, but they will allow the stack to go up several tiers, provided, of course, the floor can stand the weight and the ceiling is high enough (fig. 51).

Withdrawal procedures.--The methods and equipment used for handling frozen foods at the refrigerated warehouse also vary according to the procedure used for withdrawing the frozen foods from storage. Merchandise stored in a packer's or in-transit warehouse is usually withdrawn from storage in large quantities. Therefore, the requirement for loading out a rail car or a trailer truck is different than when the withdrawal is made in smaller quantities, as they often are at terminal warehouses in the consuming areas. When frozen foods are withdrawn from storage in carlot quantities, the operation can usually be planned well ahead of time, and thus efficient use of available facilities and personnel can be realized. At a warehouse such as those at terminal points where withdrawals are made

on short notice and the loading of trucks is usually concentrated during a short period of a few hours in the morning, the handling problem becomes quite different. Frequently mechanized equipment suited for handling large quantities of frozen foods at one time would be uneconomical for use in shuttling back and forth to the storage room to pick up only a few packages of frozen foods each trip. The withdrawal procedure in such instances might even call for the removal of only one or two packages from each of several different stacks.

Withdrawals at some warehouses are so heavy during certain times of the day that it is difficult to coincide the arrival of merchandise on the loading dock with the arrival of the vehicle that is to carry it away. Sometimes trucks have to wait on frozen foods to be brought out of storage and at other times the frozen foods have to be brought down well in advance of the arrival of the truck. Frozen foods that stand for long periods on unrefrigerated platforms are likely to have unfavorable changes in quality.



Figure 51.--Mechanical equipment, such as pallets and fork lifts, are adaptable for efficient and speedy handling of frozen foods in and out of warehouses with strong floors and high ceilings.

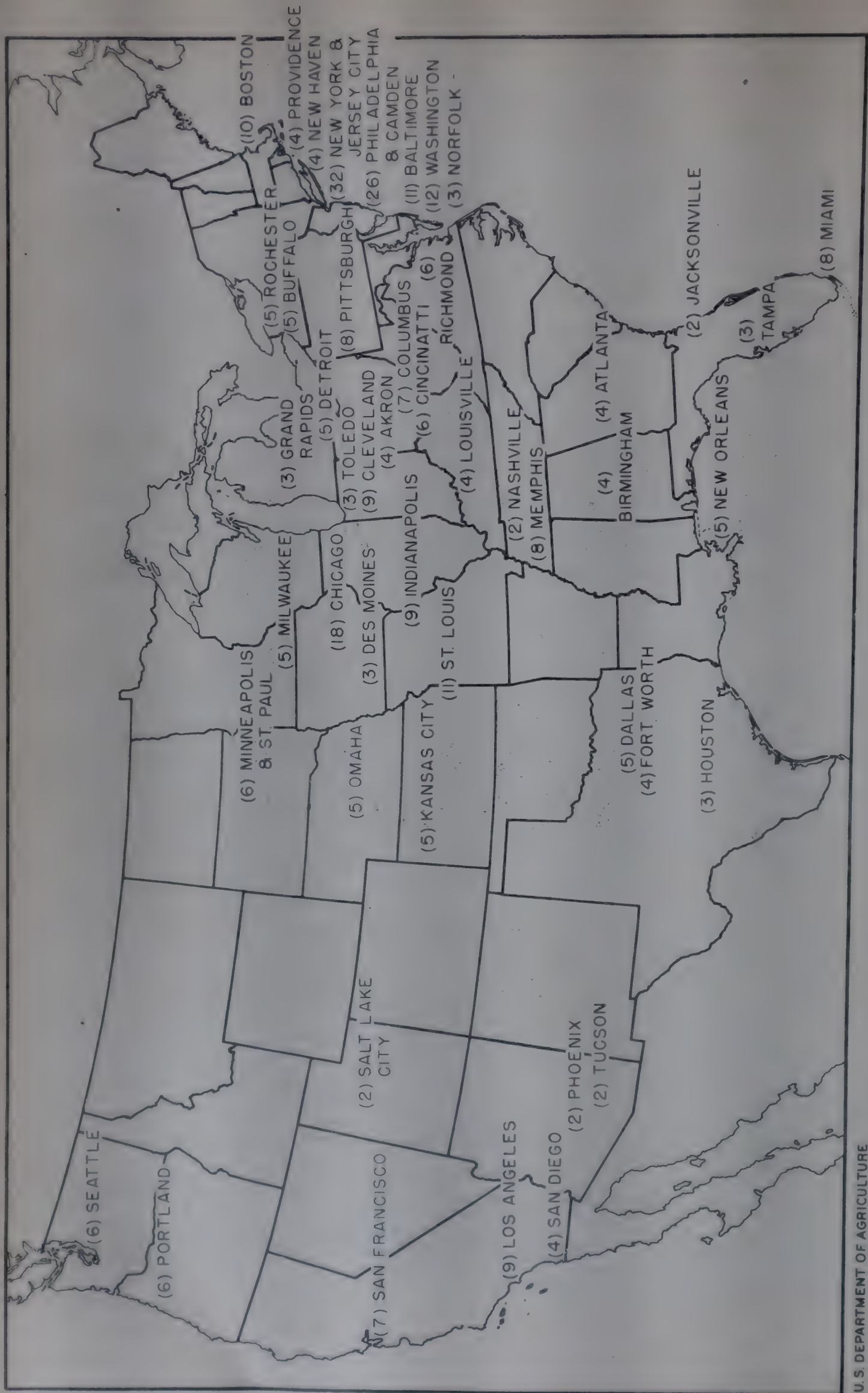
THE WHOLESALE DISTRIBUTOR 13/Areas Served

Frozen foods are distributed throughout the United States to institutional and industrial users and to retail stores by wholesale firms that are located at key geographical points of distribution. As mentioned in the Foreword, a survey was made of 315 wholesalers in 50 key cities to find out the kinds of facilities and methods of operation used by wholesale distributors. The number in these cities varied from two in several of the smaller cities to 32 in New York City. The location of the cities covered, with the number of wholesalers visited in each city, are shown in figure 52. These cities are usually points of leading commercial importance and the principal trading centers for an area. The size and shape of these trading areas vary considerably. They are usually smaller in densely populated regions than they are in the sparsely populated sections of the country. For example, a frozen-food wholesaler operating out of Dallas, Tex., may serve an area within a radius of 350 miles while one operating out of Philadelphia, Pa., would cover a territory of about a 50-mile radius. The district covered by one wholesaler serving a general consuming area may be a different size than that served by another operating from the same key city.

Although wholesalers are so situated throughout the United States that they reach most of our larger cities and towns with some frozen food, there are still a number of the smaller communities between trade areas that do not have ready access to wholesale supplies. This incomplete coverage is frequently caused by physical barriers, such as mountains, that make servicing difficult, or in some instances the community may be so remote from the wholesale key points as to make the cost of delivery prohibitive.

One of the most significant factors in determining the size of the area served by a wholesaler is the extent to which he is affiliated with a prime or packer distributor. While the independent wholesaler serves as large a territory as he feels it is economical for him to cover, the size of the trading area served by many of the agent wholesalers are restricted by their parent organizations. Such restriction is especially true when agents for the same company are located in adjoining territories. Large distributor organizations often draw geographical boundaries between their wholesalers by giving each a franchise to operate within a defined district. Of course, in some areas the "brand agent" wholesalers are so far apart geographically that their boundaries are limited only by economic factors. Most consumer trading areas can support only a limited number of wholesalers. In a survey of 50 cities, there was an average of 4 wholesalers serving the trades in metropolitan areas of 500,000 population. This does not mean, however, that there is

13/ Only those firms that handle two or more commodities are considered in this discussion. This, of course, eliminates many companies that distribute single commodities, such as eggs or fish.



U.S. DEPARTMENT OF AGRICULTURE

Figure 52.--Number of frozen-food wholesalers in 50 key cities of distribution.

a fixed relationship between the population of a trading area and the number of wholesalers that it can support. For example, in one city 5 or 6 wholesalers may be operating, whereas in a city of similar size the business may be divided between 2 or 3 larger firms.

Location Within the City

According to the survey, 36 percent of the wholesalers have at least part of their operational facilities at public refrigerated warehouses. (See fig. 35.) More than three-fourths of the warehouses from which frozen food wholesalers operate are located in or near the central business district; the remainder are found in the outlying areas of the cities.

The survey showed that of the wholesalers who were operating independent of the public warehouse, about 60 percent were located in the central business area of the city, and 40 percent in the outlying suburban area. The location of these wholesalers has been governed by several factors: (1) Location of an established business in instances where wholesalers handled unfrozen foods before taking on the frozen product;

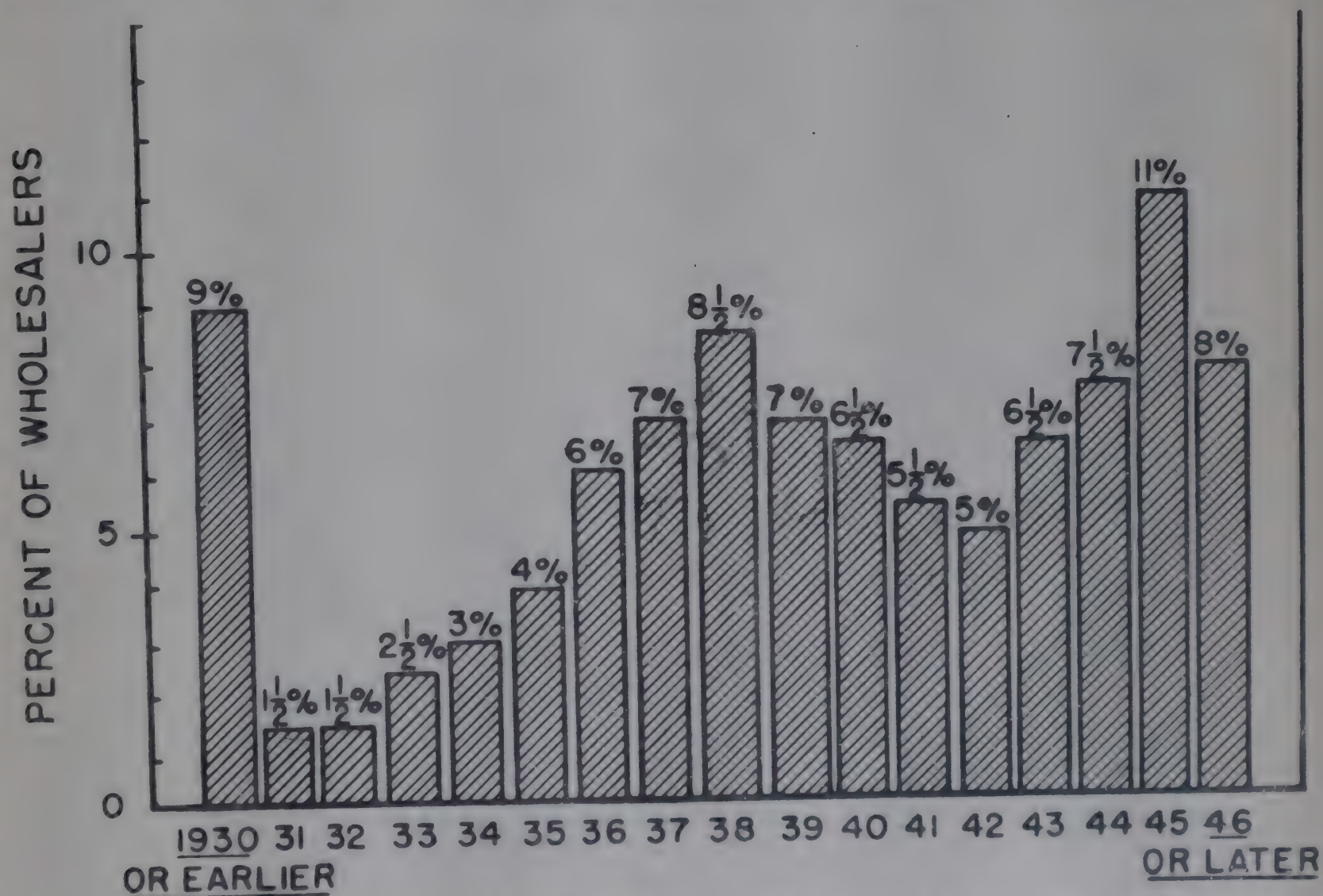


Figure 53.--Distribution of wholesale frozen food distributors by year of entrance into frozen-food business.

(Includes only those now engaged in frozen food distribution.)

(2) nature of the products distributed in addition to the frozen foods; (3) availability of refrigerated facilities; (4) real estate values; (5) location of customers served; (6) methods of transporting frozen food receipts; and (7) location of the local public warehouse when it is used for long-term storage. These factors will be discussed later under points to be considered when locating a wholesale facility and under characteristics of the wholesale distributor.

Number of Years in Business

As can be seen by figure 53, frozen-food wholesaling is a relatively new undertaking for firms that are now engaged in the business. Sixty-five percent of them have entered the industry since 1937. The oldest concerns are about 25 years old, but those concerns distributing a full line of frozen products are only about 15 years old. Most of the wholesalers who were selling frozen food prior to 1937 were dealing primarily in institutional merchandise, and practically all that were in the industry prior to 1930 were selling exclusively to the institutional and industrial trades. As can be seen further from figure 53, there was a decline in the number of firms entering into frozen-food wholesaling during the immediate prewar years and an expansion after the war started.

Wholesalers who are now distributing frozen food to retail stores have entered the business within the last few years. Their entrance, of course, is due to the importance that retail frozen foods have attained since 1944. Although numerous wholesalers have entered the distribution picture, many of them have not stayed in the business for over a year or

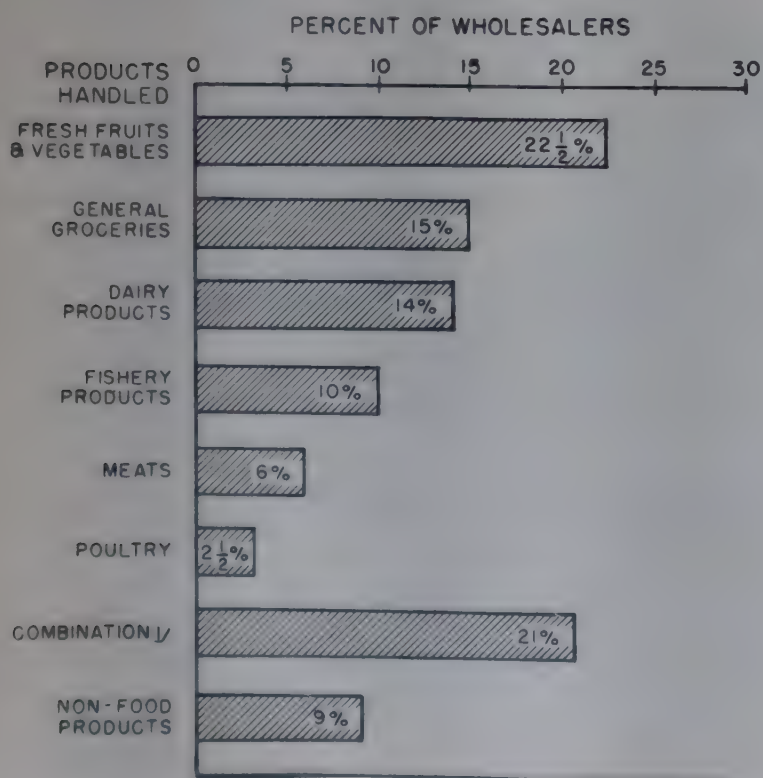


Figure 54.--Wholesalers who handle nonfrozen products in addition to frozen foods.

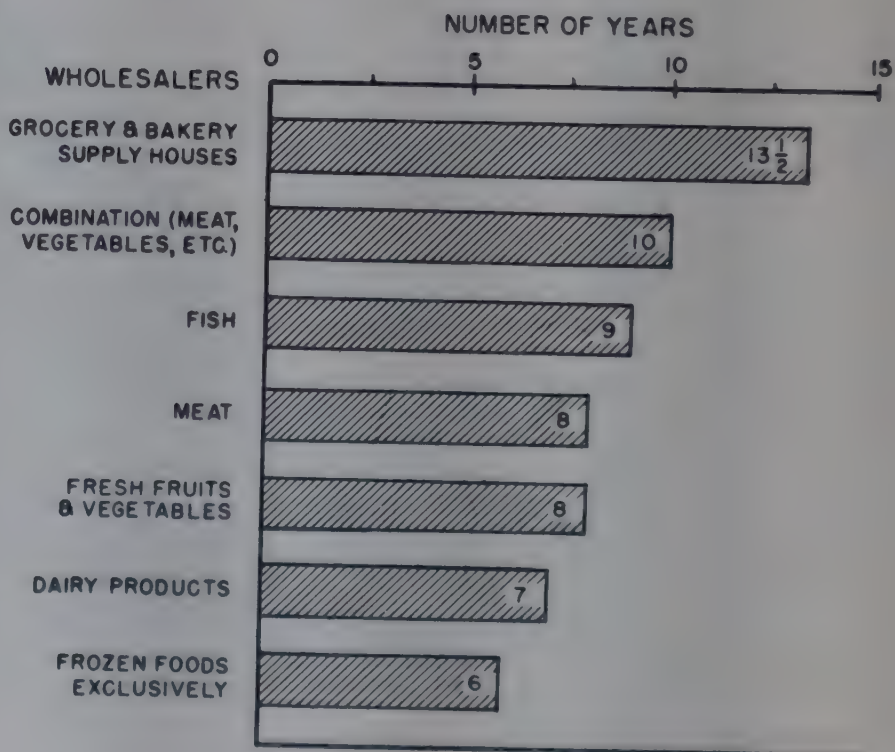


Figure 55.--Number of years that the average frozen-food wholesaler has been in the frozen food business.

two. This has resulted from several causes, foremost of which were insufficient capital, inadequate facilities, unavailability of complete supplies, losses caused by holding excessive inventories during periods of heavy supplies, lack of knowledge of frozen-food marketing, and the establishment of too many firms within a given consuming area.

Other features pertaining to the historical background of the wholesaler are closely allied with additional factors that influence his methods of operation and thus will be discussed further under appropriate topics.

Products, Other Than Frozen Foods, Handled

The wholesalers that handle frozen foods exclusively comprise 39 percent of the total, while those that handle additional products include 61 percent. The products handled by these firms fall into the general classifications: (1) Fresh fruits and vegetables; (2) general grocery products; (3) dairy products; (4) fishery products; (5) meats; (6) poultry; (7) miscellaneous food products (mostly a combination of the above); and (8) nonfood products (fig. 54). Some of the frozen-food wholesalers engaged in distributing products other than frozen foods operate their frozen-food business as a separate unit. But under such circumstances the two types of operations are somewhat closely integrated. However, most of the firms selling both frozen and unfrozen products conduct both phases as a joint enterprise and use about the same general facilities for marketing all their products.

Because at first frozen foods were packed for the institutional and industrial trades, the original wholesalers were established companies who were catering to these trades with other merchandise. Figure 55 shows the average number of years the various types of wholesalers have been selling frozen foods. The wholesalers who are handling unfrozen items in addition to their frozen products have been in the frozen-food business longer than the exclusive frozen-food wholesalers. Although the average length of time in business for the exclusive frozen-food wholesaler is 6 years, almost one-half have been in business for less than 2 years. Fifty-five percent of the wholesalers surveyed who have entered the field in the past 5 years have dealt exclusively in frozen foods.

Figure 56 shows the proportion that frozen foods are of the total business of those wholesale distributors who handle products other than frozen foods. Sixty-three percent of these wholesalers have less than one-fourth of their total business made up of frozen foods. For the most part these are wholesalers who carry only a small quantity of frozen foods to supplement their main lines.

Fresh fruit and vegetable dealers who are handling frozen foods operate almost entirely from the wholesale produce market area. This is because they were established in the fresh produce business prior to handling frozen foods. Thus, they were inclined to expand their facilities and operations to include the frozen-food business rather than to

establish an additional plant or store for such trade. There are some fresh produce houses, however, that have developed a large frozen-food business and have moved it away from the produce market to other quarters. In many cases their reason for leaving the market areas has been because of the inadequacies of facilities and the general congested conditions.

Most of the wholesale grocers who distribute frozen foods do so either from the public refrigerated warehouse or the place where they carry on their other operations. As is true of the fresh fruit and vegetable dealer on the produce market, his facilities are not always well adapted to the efficient handling of frozen foods.

Many wholesalers of dairy products operated in a public warehouse before adding frozen foods to their line of business. Of course, these wholesalers have continued to operate from the warehouse. Since in most cases their dairy commodities require cooler if not freezer facilities, the dairy products wholesaler in taking on frozen foods has to make less alteration of his existing facilities than do other wholesalers.

Wholesalers who are handling several food products that are not frozen, such as meats, groceries, fruits, vegetables, and beverages as well as frozen foods, were found to have their facilities located chiefly in the central business area.

There has been much controversy as to the advantages and disadvantages of operating a frozen-food wholesale business in conjunction with another type of food business. Exclusive frozen-food wholesalers have contended that if sales are to be developed in the face of strong competition, it is necessary for the frozen-food operation to be conducted separately from other types of businesses. They contend that frozen foods require facilities and handling methods different from other foods, and that in order to realize a large degree of success, the business should be conducted as a specialized function. On the other hand, the frozen-food wholesalers who also handle other food products have stated that their system is best because they can utilize existing facilities, sales, and office personnel in handling frozen foods in conjunction with their other operations. Also, the appliance dealer argues that his system has great advantages because frozen foods and refrigeration facilities complement each other.

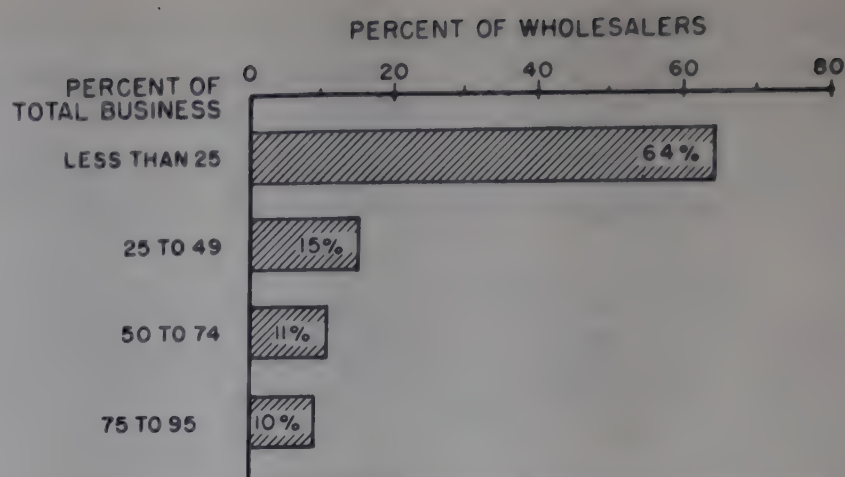


Figure 56.--Relation of frozen-food volume to total business of those wholesale distributors who also handle unfrozen products.

Kinds of Frozen Foods Distributed

Although most frozen-food wholesalers who distribute their products to the retail trade handle each of the principal commodities that are frozen, there are many wholesalers serving the institutional and industrial trades who handle only a few selected items. For example, a caterer to bakeries will often handle only fruits or eggs. Likewise, a poultry wholesaler might handle frozen poultry and not sell other frozen foods. It can be seen from figure 57 that of the wholesalers interviewed, 92 percent reported distributing frozen fruit, 90 percent vegetables, 62 percent poultry, and 61 percent fish. (Eggs are not included in chart because of insufficient data for this item.) Frozen meats, frozen pre-cooked foods, and specialty items, although sold by quite a few regular wholesalers, are often sold in large cities by local concerns that prepare these items in specialized kitchens. Most frozen eggs are sold by wholesalers who specialize in this product and who cater to the institutional and industrial trades.

Degree of Affiliation with Other Distributors

As discussed earlier under organization of the industry, there are many wholesalers who are agents for distributing the merchandise of a packer distributor or a prime distributor. For the most part these wholesale firms are independent concerns that have working agreements to handle a distributor's merchandise exclusively in an area. Since the primary and packer distributors often have a choice as to who is to handle their product, their policies are instrumental in determining the wholesaler they select. Some distributor might prefer an agent who handles frozen foods exclusively; another might prefer a grocery wholesaler as his agent; while still another distributor might prefer a dairy products firm. Also, some prime and packer distributors are instrumental in determining whether or not wholesalers operate in public warehouses. In the survey, almost one-half of the agent wholesalers were operating in public warehouses as compared with about one-fourth of the independent wholesalers.

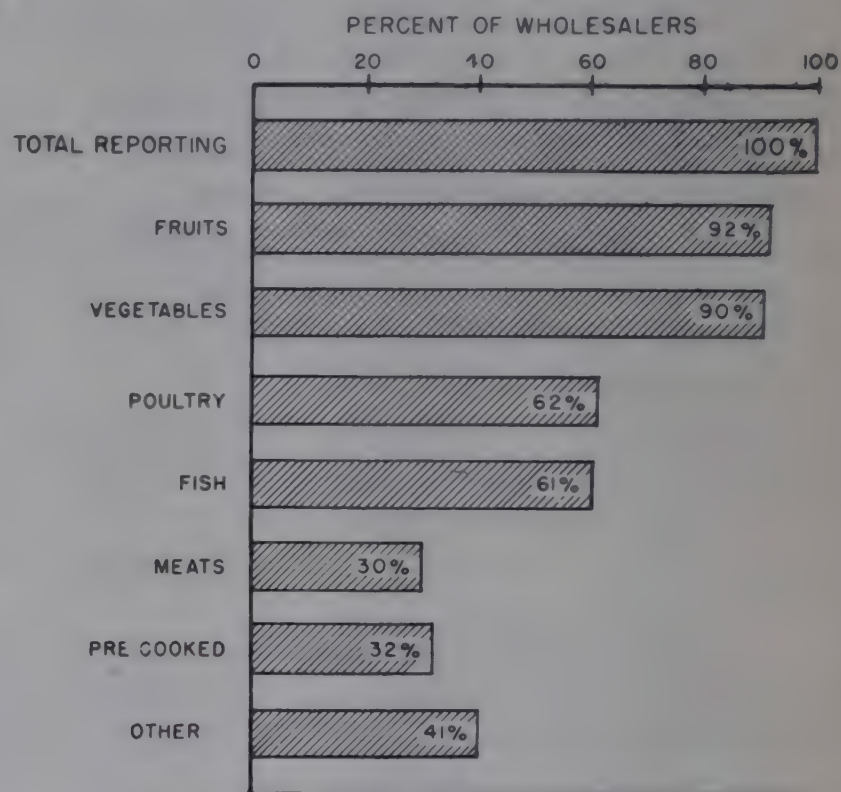


Figure 57. --Wholesale distributors handling various types of frozen foods.

In some cases a wholesaler who gets his frozen foods direct from packers or who packs his frozen foods himself will have wholesale outlets in several cities. Under these circumstances the policy of the company's central management will determine various wholesale plant

locations, methods, and facilities used.

Brands of Frozen Foods Handled

Seventy percent of the wholesale distributors surveyed handled primarily one specific brand of frozen foods. Although most of the brand wholesalers are agent distributors, there are a few independent wholesalers who sell specific brands that are acquired by contract with packers or by the wholesaler packing frozen foods himself under his own label. Generally, independent wholesalers, particularly those catering to the institutional and industrial trades, carry a variety of brands rather than one specific brand. Figure 58 shows the number of brands handled by wholesalers who carry a variety of brands.

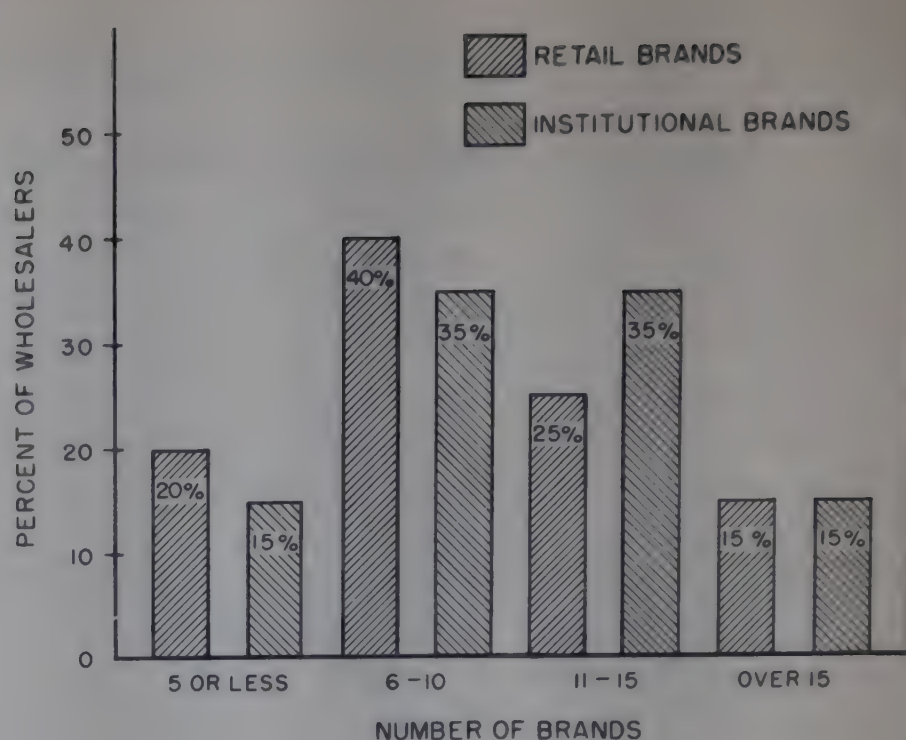


Figure 58.--Number of brands carried by wholesalers who handle more than 1 brand.

Type of Trade Served

Sixty-five percent of the wholesalers surveyed distribute frozen foods to all three of the using trades - institutional, industrial, and retail; 24 percent distribute to the institutional and industrial trades only; and 11 percent sell to the retail trade only.

Facilities for Unloading Railcars and Trucks at the Wholesale Plant

Virtually all refrigerated warehouses in which frozen-food distributors operate have direct rail connections. Also, they have loading docks for trucks.

Wholesalers who operate their frozen-food business independent of refrigerated warehouses are less likely to have direct rail connections to their facilities. Only 28 percent of such wholesalers visited are located on rail sidings. The combination-type wholesalers and the grocery firms are the best equipped in this respect, nearly one-half of them having rail facilities.

The wholesaler of fresh fruits and vegetables generally depends on rail for much of his fresh produce as well as for frozen foods. But of such firms visited, only 11 percent had rail connections. This situation is largely the result of the fact that fresh fruit and vegetable wholesale stores are located in produce markets, many of which were constructed before direct rail connections were considered necessary to the produce firms.

About two-fifths of the exclusively frozen-food wholesalers have rail connections, which is above the average for all wholesalers who operate independent of refrigerated warehouses.

It is significant to note that three-fourths of the wholesale distributors who depend primarily on rail shipments of frozen foods into the city, do not have direct rail connections to their plants.

About 40 percent of the wholesalers who operate independent of the refrigerated warehouses have no platforms at truck-bed level. This situation, of course, requires extra effort in lifting frozen foods to and from the ground to the truck.

Wholesaler's Plant

The wholesaler's plant consists of a combination of facilities that are necessary for conducting sales of frozen foods to the trades. Although the long-term storage facility can be a part of this wholesale plant, it is generally considered separately. Only a small percentage of the wholesalers perform long-term storage in space which they also use as an operational facility.

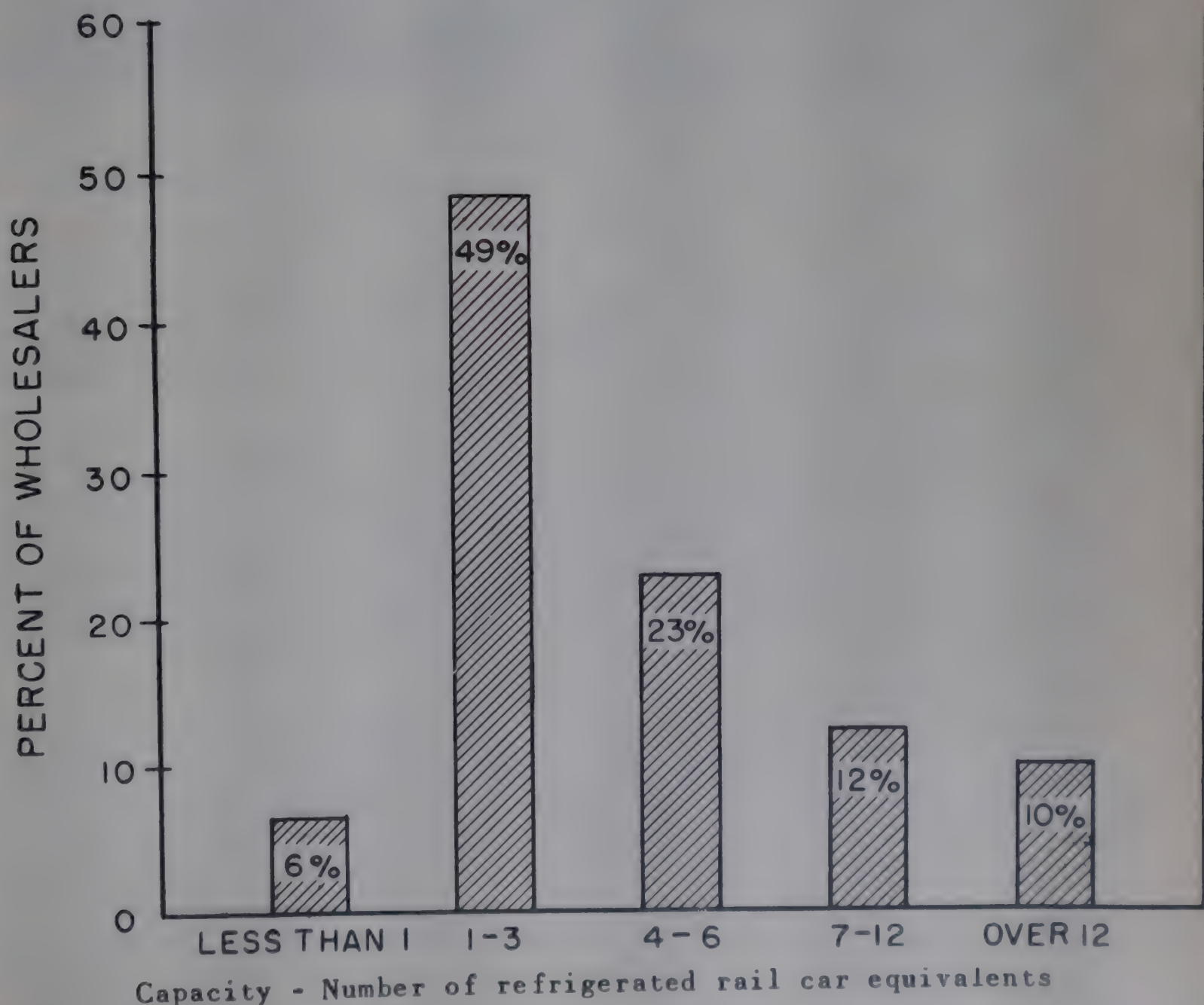


Figure 59.--Size of wholesalers' short-term storage facilities.



Figure 60.--Some wholesalers have order break-down rooms, held at zero degrees, where cases of mixed frozen foods are assembled for delivery to retail outlets.

The several essential facilities of these plants are: (1) A short-term storage room which is commonly held at 0° F.; (2) an order assembly room which sometimes is a part of the short-term storage room; (3) an area for loading trucks; and (4) office space.

The purpose of the short-term storage room is to serve as a reservoir from which supplies can be withdrawn as needed for each day's operation. These rooms in about three-fourths of the plants will not hold complete supplies for more than a week or two. In cases where the wholesaler owns or controls long-term storage facilities that are adjacent to the wholesaling plant, the need for a short-term storage room is considerably decreased.

The size of the short-term storage sections of the wholesale plants visited range from a capacity of less than one-fourth carload to more than 20 carloads. The most common size, as shown in figure 59, was from 1 to 3 carloads. In fact, nearly one-half of all such holding rooms are within this range. Another 23 percent of the wholesalers have plants of from 4 to 6 carloads capacity. In many instances the short-term storage rooms are only partially filled because of the need for providing ample working space.

Although some wholesalers assemble orders in the same room where they store for short-term, many use assembly rooms that are separate from the short-term storages (fig. 60). This arrangement is necessary when cartons are broken to fill orders of less than a carton of an individual commodity. Under such circumstances the frozen foods are moved into the order assembly room from short-term storage and then repacked according to the orders to be filled for various customers. Wholesalers who use this system are predominantly those that take orders prior to delivery; they constitute 69 percent of all wholesalers visited. In practically all cases where an order assembly room and the short-term storage room are separate units, they are physically adjacent to each other, which is a most desirable arrangement. Although the order assembly rooms in most wholesale plants are refrigerated, a few wholesalers use unrefrigerated rooms to good advantage. However, in such an arrangement the frozen foods must be passed through the room in only a few minutes.

More wholesalers with short-term storage facilities ranging in size from 1 to 6 carloads were operating within refrigerated warehouses than were the wholesalers with larger or smaller capacities. A wholesaler whose volume of business requires only a small holding room is inclined to improvise his own short-term storage. In some cases he might even withdraw a day's supply of frozen foods from the public warehouse each morning and not have a private storage at all.

At the other extreme, many of the wholesalers whose plants provide storage for more than 6 cars of frozen foods operate in private facilities rather than in the public warehouse. Wholesalers with a large volume of business find some economic advantages in providing their own facilities rather than renting a large room in a public warehouse. Many of these wholesalers also emphasize that their private storage gives them more freedom of operation, particularly with regard to traffic, hours of opening and closing, and privacy of business transactions.

It should be pointed out that although there is a high degree of correlation between the capacity of the wholesale plant and the volume of frozen-food business, some firms with small plants handle considerably more frozen foods than others with larger facilities. In some cases, the wholesaler who is doing a large business from a small plant is realizing an advantage in efficiency of operation, but for the most part he is realizing inefficiencies brought about by cramped conditions.

A greater percentage of wholesalers might be operating within public warehouses if more warehouses were equipped with zero storage rooms suitable for an efficient wholesale frozen-food operation. Many of the refrigerated warehouses in use today were constructed when cooler space was in greater demand than freezer space and when the frozen-food type of operation was not common.

Since practically all frozen-food deliveries are made by truck, it is essential that a suitable area be available for loading out these vehicles (fig. 61). At first thought this would seem to be a simple problem for wholesalers to overcome, but frequently it has been found

that the area they have for this purpose is far from adequate. In many cases the loading area will accommodate only a few of the wholesalers' trucks at one time. This means that trucks have to stand idle while waiting for a vacant place to back into to be loaded. Not only is it necessary to have an adequate area for conducting this operation, but it is important that loading docks be at the proper height to make the loading task more efficient. In cases where the company uses delivery trucks that are "plugged" into the plant's electrical current or into the refrigerant pipe line, fixtures are provided at or near the loading docks.



Figure 61.--Truck-loading areas at wholesale plants should be spacious and well lighted. A covered loading zone permits normal operation even in inclement weather.

Most frozen-food wholesalers who have their own plant have offices located in it. However, about one-half of those located in public warehouses have offices elsewhere.

Handling Equipment

An otherwise well-planned wholesale plant will operate inefficiently if the equipment for handling frozen foods is not suited to the particular plant lay-out.

Conventional hand trucks are used by most wholesalers in their plants. These trucks are especially useful for carrying merchandise from the short-term storage room to the order assembly rooms or directly to the delivery trucks. In some plants the operation is set up so that other equipment, such as gravity and power conveyors, jacks and skids, and pallets and fork-lift trucks are used to good advantage. A surprisingly large number of wholesalers rely on manual labor as their main method of moving frozen foods within the plant. However, most of the firms that use this method are wholesalers whose frozen-food operations are small or just incidental to the main line of business.

Operations at the Wholesale Plant

Moving of products.--As previously pointed out, the location of the long-term storage facility in relation to the wholesaler's plant influences the job of moving frozen foods within the city. In this respect, there are about three general conditions that prevail. When the long-term storage room is adjacent to the short-term storage or order assembly room, the transfer of frozen foods from one facility to another is relatively a simple task. The problem becomes a little more complicated when the warehousing and wholesale operations are performed in different

parts of the same building. This situation is common where the wholesale plant is located in the public warehouse. When the long-term storage and the wholesaler's plant are in different buildings, the problem of moving merchandise from the warehouse to the order assembly room becomes much more difficult and costly.

When a wholesale operation is located in a public warehouse the transferring of frozen foods from general storage to the order assembly room involves moving the products by elevators and other conveyors from one part of the warehouse to another. The number and size of withdrawals from general storage made by the wholesaler varies with his volume of business and the size of his rented facilities. As can be seen from figure 62, almost 40 percent of the wholesale distributors who operate within a public warehouse have frozen foods transferred daily to their premises. The usual procedure for a withdrawal is for the wholesaler to notify the warehouseman at regular intervals as to the quantity and kinds of frozen foods he wants delivered. For example, a wholesaler who withdraws frozen foods from general storage each day might notify the warehouseman each afternoon what his requirements are for the following day, and the commodities will be delivered at a certain hour the next morning.

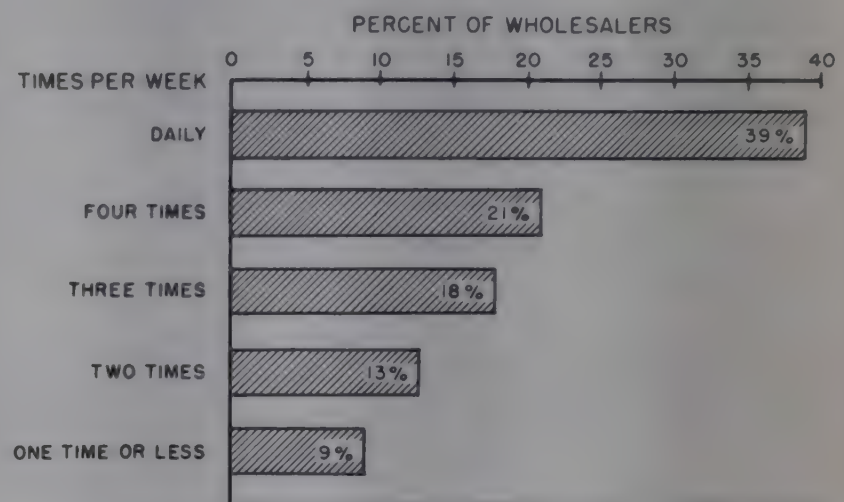


Figure 62.--Average number of times per week that frozen foods are withdrawn from general storage by wholesalers who have plant facilities in a public warehouse.

As discussed in the chapter on warehousing, the expense of delivering frozen foods from general storage is covered by a handling fee that is assessed at the time that the products come into general storage. However, in recent years some warehousemen have assessed an additional withdrawal fee covering separate deliveries. A wholesaler whose plant is located in the warehouse and who rents only a small order assembly room is likely to find that his expense for withdrawing frozen foods from storage will amount to a substantial part of his operational cost.

As previously shown, most wholesalers who have plants that are not located in the public warehouse still depend on the warehouse to perform their long-term storage. Naturally, this separation of the long-term storage facility and the wholesale plant necessitates moving the products by truck from one place to another (fig. 63). This transfer is commonly referred to as cartage, and is one of the large problems faced by wholesale distributors. When a wholesaler makes several trips each week to a warehouse that is accessible only through several miles of congested traffic, then this cartage is likely to amount to a large proportion of his operating expenses. One of the main reasons why a wholesaler operates in a public warehouse or builds his private operational facility large

enough to accommodate at least part of his long-term storage is the high cartage cost incurred when the storage is performed separately from the wholesale operation.

Assembling orders.--The wholesaler's task of assembling frozen-food orders for delivery to the trades varies with the type of sales system used and with the type of trade served. When frozen foods are sold in advance of delivery, each customer's order is assembled as a separate unit and held at the plant until dispatched on a regular delivery route. (See fig. 60.) On the other hand, wholesalers who sell frozen foods from the truck as they visit each potential user do very little preassembling of orders, but instead they load their trucks with an assortment of merchandise at the time it leaves the plant. Although institutional and industrial users are often solicited by the wholesaler for orders in advance of delivery there are several factors, such as the larger size of packages, the relatively small number of orders per day, and the occasional short-notice service required, that influence the method used by the wholesaler to assemble such orders.

The number of men used by wholesalers to assemble orders varies with the size of business and with the alternate use to which labor can be put. A frozen-food wholesaler with a small business will require only one man to assemble orders, and a wholesaler who also has a nonfrozen-food business might use men to assemble orders who are used part-time on other jobs. According to the survey almost one-third of the wholesalers use less than 8 man-hours a day for this work. This can be accounted for in part by the many small operators who use only one man to prepare orders. Many firms serving only the institutional and industrial trades use several men to assemble orders for an hour or so and then use them for other jobs.

As shown in figure 64, over one-third of the wholesalers assemble fewer than 50 orders per day. Although many of these firms have only a small frozen-food business, there are some that serve the institutional and industrial trades with large amounts of frozen foods but with few orders. A firm that caters only to institutional and industrial users might sell only 3 or 4 orders in one day, yet the size of each order may run well over 500 pounds, which, according to weight, is several times more than the average retail order.

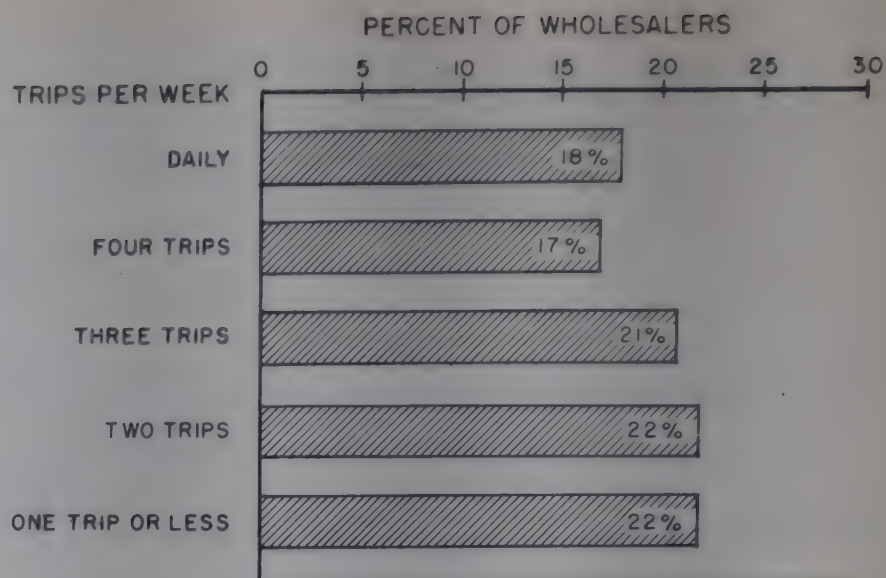


Figure 63.--Average number of trips to local warehouses made by wholesalers who operate from facilities independent of the warehouse.

When each customer's order comes to the assembly room, the items requested are listed on a sheet which is usually referred to as an order sheet (fig. 65). Items that require less than a full case are repacked to make full mixed cases. Containers are then marked with the customer's number which corresponds to his number on the order sheet. Scales are often used in assembling orders for the retail trade as a final check against error in getting the right number of packages for each customer. Most of the 62 percent who do not use scales are accounted for by the wholesalers who use the wagon sales method, those that cater to the institutional and industrial trades exclusively, and those that handle only a small volume of business.

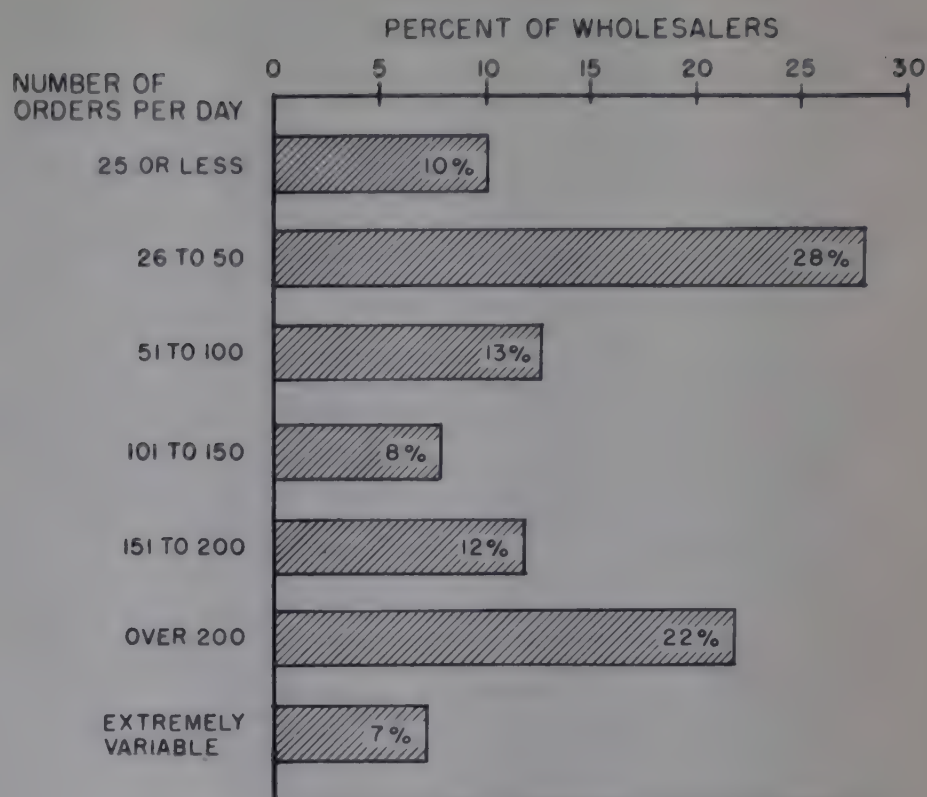


Figure 64.--Average number of orders delivered daily by frozen-food wholesalers.

Although most of the wholesalers assemble their orders in refrigerated rooms, a few do not. Some of the assembly rooms that are refrigerated are maintained at a temperature considerably above zero degrees. In most instances where the temperature is over 10° F., the order room is not used for short-term storage. Among those who do not use refrigerated rooms for assembling orders are several wholesalers who actually use rooms where the temperature is maintained at about 70°. In such cases, the frozen food usually passes through the room rather rapidly and when the orders are assembled they are replaced in zero storage for holding prior to delivery. One of the main advantages of this system is that the order assembly crew works under more comfortable conditions; hence, their performance is likely to be better than when they work under zero temperature. When men work at zero degrees it often becomes necessary for them to spend 10 or 15 minutes of each hour in a warmer room. Of course, the biggest disadvantage of the arrangement where the orders are put up in high-temperature rooms is that the food is exposed to undesirable conditions. Users of this system contend, however, that the frozen food is passed through the unrefrigerated room in such a short time that the quality of the product is not affected.

Recommendations for a Wholesaler's Plant Lay-Out

Factors to consider in selecting a location.--The location of a wholesale plant in a distribution area can do much to influence the operating efficiency of a frozen-food business. The main factors to be

Check this week's market letter before ordering.
Telephone before noon, day before delivery . . . afternoons for second-day delivery.

Doe Frozen Food Co.

Phone
WA 7706

NAME _____ CUSTOMER No. _____ Date _____

STREET _____ ROUTE No. _____

CITY & STATE _____ TERR. _____ DATE WANTED _____

Brand, unless otherwise specified

Dozen	Code	FRUITS	Oz.	Boxes	Code	FISH	Lb.	Dozen	Code	PACKERS LABELS	Oz.
	104	Applesauce	16		310	Cod Fillets	5		152	Mixed Fruits,	16
	112	Apricots	16		320	Flounder Fillets	5		164	Peaches,	16
	120	Blackberries	13		330	Haddock Fillets	5		272	Raspberries, Farmers Co-op	16
	125	Blu-berries, Tru	11		340	Lake Trout Fillets	5		173	Raspberries,	16
	128	Boysenberries	13		345	Red Perch Fillets	5		180	Rhubarb,	16
	149	Mixed Fruit	16		350	Mackerel Fillets	5		189	Strawberries, Sliced	16
	156	Peaches, Sliced	16		360	Whitefish Fillets	5		190	Strawberries, Sliced	14
	176	Rhubarb	16						212	Asparagus Spears,	12
	184	Strawberries	16						237	Lima Beans,	12
				Dozen	Code	SHELLFISH	Oz.		242	Fordhook Lima Beans,	12
					370	Oysters	12		248	Broccoli,	10
					380	Scallops	12		257	Brussels Sprouts,	10
					390	Shrimp	12		261	Cauliflower,	10
									290	Soy Succotash,	12
Dozen	Code	VEGETABLES	Oz.	Cases	Code	POULTRY	Lb.	Cases	Code	CONDIMENTS & JUICES	Oz.
	201	Asparagus Cuts	12		420	Fryers	1 3/8-1 3/4		650	Vegemato,	#2
	207	Asparagus Spears	12		430	Fryers	1 7/8-2		651	Vegemato,	46
	215	Cut Green Beans	10		440	Fryers	2 1/8-2 1/2		652	Catsup,	14
	218	French Green Beans	10		450	Fryers	2 1/2-2 3/4		653	O.F. Chili Sauce,	11
	227	Wax Beans	10						654	Cocktail Sauce,	11 1/2
	233	Lima Beans, Green	12								
	239	Fordhook Lima Beans	12	Head		POULTRY	Sizes				
	245	Broccoli	10 or 13		461	Roasters	Small				
	254	Broccoli Cuts	10 or 13		461	Roasters	Large				
	258	Brussels Sprouts	10 or 13		471	Fricasse of Fowl	Small				
	259	Carrots & Peas	12		471	Fricasse of Fowl	Medium				
	260	Cauliflower	10 or 13		471	Fricasse of Fowl	Large				
	263	Corn, Cut	10		481	Turkeys	Small				
	264	Corn on Cob	4 ears		481	Turkeys	Medium				
	266	Mixed Vegetables	12		481	Turkeys	Large				
	272	Peas	12		491	Ducklings					
	275	Pumpkin Pie Mix	16								
	281	Spinach	14								
	282	Spinach, Chopped	14	Dozen	Code	SPECIALTIES	Oz.				
	284	Squash, Cooked	16		530	Chicken a la King	11				
	285	Succotash, Lima Bean	11		540	Chop Suey (Veg.)	16				
	287	Succotash, Soybean	11		560	French Fried Potatoes	10				
					590	Pot. Pancake,	16				
				CS	595	Dog Food, Perk	16				
				Dz.	655	Orange Juice Concentrate	6				

✓ **HAVE YOU** checked this week's Market Letter for nationally and locally advertised features and list of products on sale this week?

✓ ✓ **DOUBLE - CHECK** your name, address and date wanted, then mail or telephone early, please.

Send supply of this Form

✓ **HAVE YOU** checked this week's Market Letter for nationally and locally advertised Features and list of products on sale this week?

✓ ✓ DOUBLE - CHECK
your name, address and
date wanted, then mail or
telephone early, please.

Send supply of this Form

Order early and often for fast

turnover . . . don't wait for salesman!

Figure 65.--A typical example of an order sheet used by frozen-food wholesalers. The order can be filled-in either by a salesman or by a retail store operator.

considered in choosing a location are: (1) Location of established facilities especially if wholesaler is already distributing other lines of merchandise; (2) nature of the products distributed in addition to frozen foods; (3) size of the frozen-food business; (4) adequate space for expansion; (5) methods of frozen-food receipts; (6) real estate values; (7) location of the public warehouse when it is to be used for long-term storage; (8) location of customers to be served; and (9) adequacy of power and other utilities.

Location of established facilities.--In a time when building costs are high, it is sometimes better for a wholesaler to use an established facility for a plant if adequate ones are available, rather than build a new one. In this respect he has three possibilities. He may operate in the public warehouse if conditions there are favorable; he may use his own facilities for distributing frozen foods if he is already engaged in another enterprise; or he may rent an existing building and improvise a plant for handling frozen foods. In any event, the wholesaler must remember that during the time when he is striving to gain a secure foothold in the perishable food market, it is important that he use the most efficient facilities to be had. In many instances this will call for the construction of an entirely new plant. Before making a decision as to where to locate his business, the wholesaler should compare the cost of operating in various types of facilities, giving due regard to the importance of having space included in the wholesale plant for long-term storage of at least part of the year's supply. Frequently a wholesaler will not have sufficient capital to provide an adequate plant. In such cases, his chances of success are considerably decreased. This has been proved by the failure of ventures into the frozen-food field by wholesalers using improvised facilities that were expensive to operate.

Nature of the products handled in addition to frozen foods.--Closely allied with the effect that the location of an established business might have on the location of the frozen-food business, is the type of products handled in addition to frozen foods. A dealer in fresh fruits and vegetables who also handles frozen foods might find that for the benefit of his fresh produce business he should locate his entire business on the wholesale produce market. On the other hand, a wholesaler who distributes fresh meats from a plant in the public refrigerated warehouse may find advantages in locating his frozen-food operation in the same facilities from which his meat is distributed. It can be said, generally, that if the frozen-food business is not too large, there are good advantages for locating it in the same plant with the other enterprise, provided refrigerated facilities are needed for both products. If the nonfrozen products require little or no refrigeration, as is true in the case of dry groceries and some fruits and vegetables, then usually there is not much to be gained from a facilities standpoint in having the operations together.

Size of the frozen-food business.--If the volume of frozen-food business is small, the wholesale plant may function economically in a location that would be adverse if the size of the business were large. For example, where the operation requires facilities of less than one-car

capacity and where only one or two delivery trucks are used, the frozen-food business may be located to good advantage in the same plant already used by the established firm. Or in such cases, a site may be selected in a congested section of town where very little loading area is required and where plant accessibility is not important. A frozen-food business with a small or medium volume might do well to select a public refrigerated warehouse for its operational facility if other factors of location are favorable. Larger firms usually need plenty of room; therefore, their requirements may demand a facility separate from all other types of operation.

Adequate space for expansion.--One fundamental factor that has to be considered in selecting a location is the adequacy of facilities for future expansion. Many wholesalers have found that their business quickly expanded beyond the facilities that were used when it was first established. In far too many instances, the growing enterprise could not be cared for economically in the old location, and new facilities had to be acquired. Any wholesaler going into frozen-food distribution should avoid the mistake of having the growth of his business restricted by a lack of adequate room for expansion. In this respect, he should make sure that his initial facilities contain proper provisions for growth of the enterprise. For this reason, it is often advantageous for a wholesaler to locate his plant in a section of town where additional land can be acquired at a low cost.

Frozen-food receipts.--It is very important that a wholesaler locate his plant so his frozen foods can be received efficiently and conveniently. If he is in any way dependent on rail receipts and has adequate storage facilities for holding carlots, then by all means he should have rail connections to his plant. In the event that a considerable part of his receipts arrive by truck, the plant should have ready access to nearby highway connections. Not only is it important for the plant to be near an arterial highway, but adequate room should be available at the plant so that large trailer trucks can be unloaded without having to wait for space at the unloading dock, and without delaying regular plant operations.

Real estate values.--Although it may be advantageous for a wholesaler who caters mainly to the institutional trade to locate his plant close to his customers, if this central point should be in the downtown area he might find real estate values so high as to discourage such a convenient location. Those wholesalers who serve the retail trade find very little need for being in the retail downtown business area of high real estate value, except in cases where location in or near the public warehouse is desirable. Low real estate values are desirable because they reduce the overhead cost of operation and give the beginner in frozen-food wholesaling a much better chance to realize a successful business venture. Since the price of real estate tends to be lower in areas where tracts of land are set aside by the municipality for industrial promotion, it is often advisable for a wholesaler to investigate possibilities before building in these locations.

Plant location in relation to public warehouse when latter is used for long-term storage.--The convenient location of the stocks of frozen foods in storage is very important to the successful operation of a frozen-food wholesaling business. As previously pointed out, a wholesaler's plant should be located near the warehouse where his immediate supplies for operation are being held in long-term storage. If most of the wholesaler's products are stored in a warehouse some distance from his plant, it takes more time and costs more to transfer them. This problem can be overcome by locating the plant within the public warehouse or by providing space at an independent facility to accommodate at least part of their long-term storage. When wholesalers store products for a long term in their private facilities and in in-transit warehouses only, the location of the frozen-food plant in relation to the local warehouse is unimportant.

Location of customers to be served.--In establishing a wholesale plant the location of the customers to be served should be given every consideration. For example, a wholesaler who specializes in serving the institutional and industrial trades and finds that most of his deliveries are centered in the downtown area should consider his location in regard to theirs. Not only should the factor of distance between plant and customers be given consideration but also the possible routes of delivering should be studied with the idea of locating the wholesale plant near good traffic arteries in the direction of heaviest deliveries.

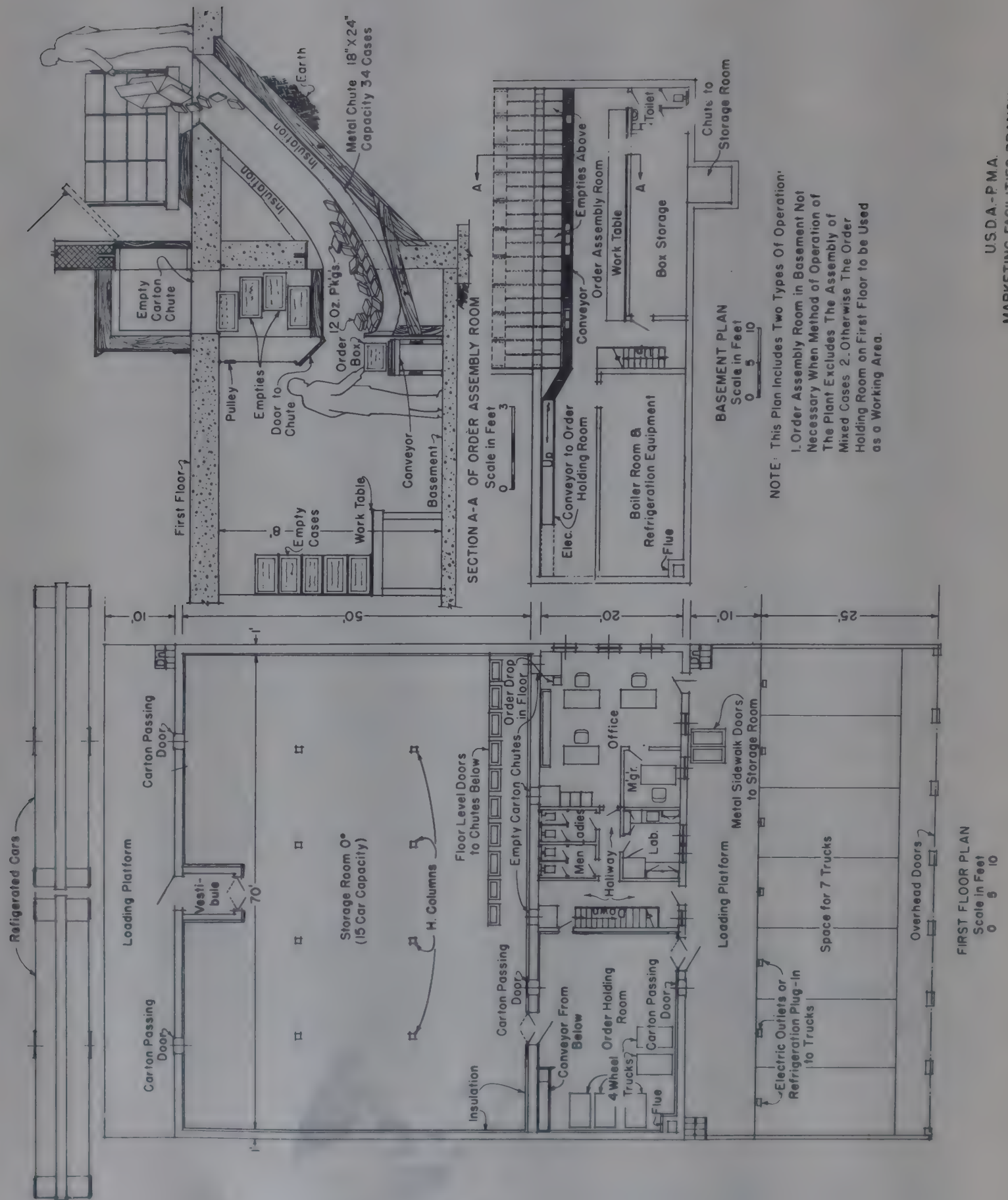
A wholesaler who caters primarily to the retail trade might locate his plant in a spacious suburban area of town and serve his customers by skirting the business district when making deliveries. A wholesaler who has a large out-of-town business serviced by trucks can gain an advantage by placing his plant on the side of the metropolitan area that would favor the direction of his long-distance hauls.

Adequacies of power and other utilities.--A plant located within the limits of a city likely will find adequate utilities readily available; whereas a plant located in an outlying area of a city might find that the acquisition of such utilities as power, sewerage, and water constitutes a problem worthy of advance consideration. Above all, the availability of a continuous supply of electric power should be assured before the location is selected. Since the compressors for providing the refrigeration for the plant will likely be dependent on the public power lines, the failure of this power for a short period could result in unfavorable storage conditions.

Plant Design

Even though the plant is well located, it must also be properly designed. (Figures 66 and 67 show a recommendation for a plant lay-out.) Some of the features to be desired in the plant lay-out are as follows:

Long-term storage room.--One of the first problems is to design the facility so that the long-term storage room, where frozen foods are held for several months, will be kept at zero degrees. There should be no



USDA-PMA
MARKETING FACILITIES BRANCH

Figure 66.--Possible lay-out for a frozen food wholesale plant.

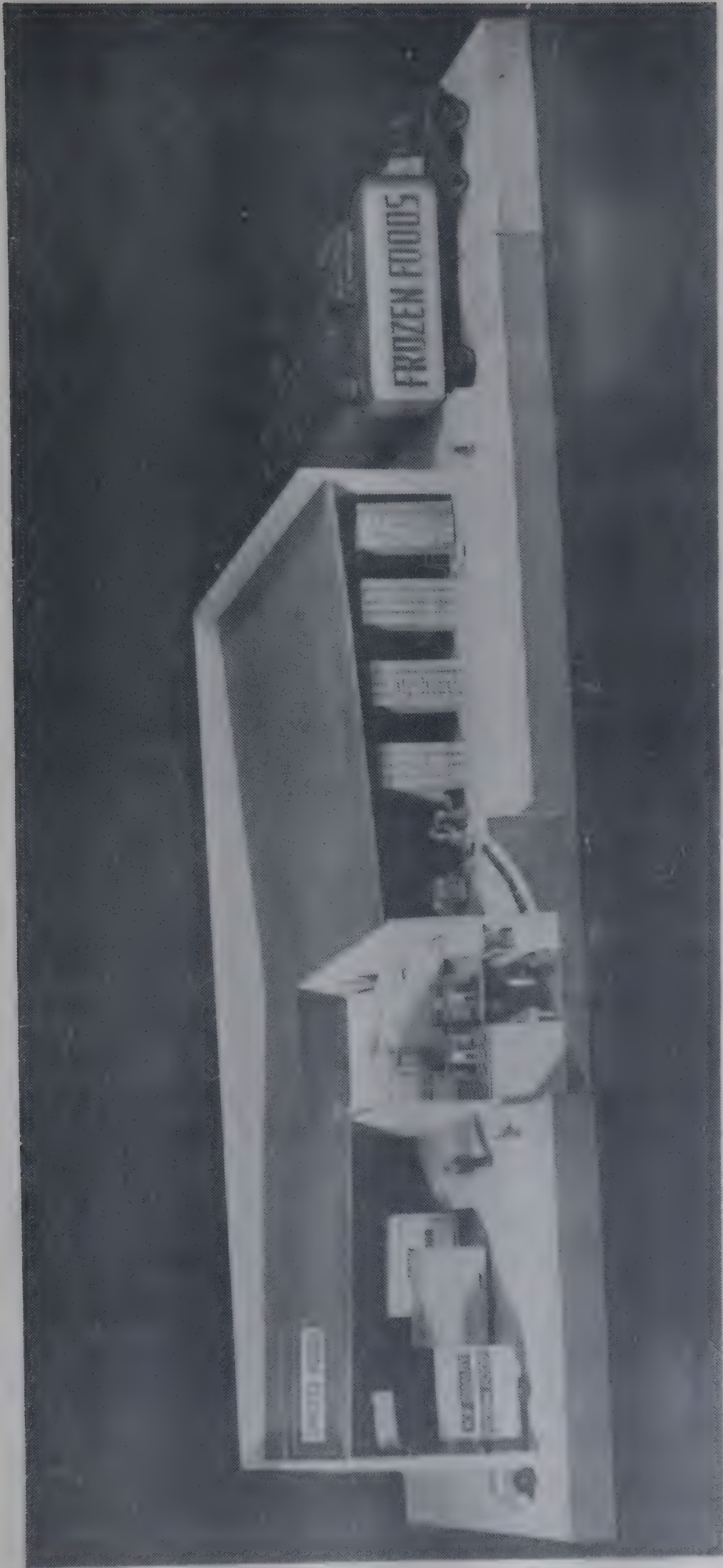


Figure 67.--A cut-away side view of a model frozen-food wholesale plant designed according to the plans shown in fig. 66.

incentive, caused by the design of the building, to use the storage room as a "working area" for assembling orders. Also, the doors must be so arranged that merchandise can be brought in on one side of the room without interfering with the out-movement on the other.

Order assembly room (optional).--The order assembly room is necessary for those wholesalers who break the wholesale-size carton in order to sell less than a carton to a customer if they use the advance sales type of selling and assembling orders prior to delivery to the trade.

The first requirement of this room is for it to be located adjacent to the storage room and the order holding room so that efficient methods of handling can be incorporated in transferring merchandise from one room to the other.

The assembling operation will be much more efficient if the men who assemble the orders can work in a room with a high enough temperature to keep them comfortable. Such a procedure can be satisfactorily worked out, if the rooms are favorably planned so that the frozen food can pass through an unrefrigerated assembly room on a continuous conveyor, an order can be made up in a matter of a few minutes, and the assembled order can be carried again to zero storage. Of course, the success of such an arrangement depends on the assembly room being so designed as to discourage workers from having any frozen food in the room except that which is actually passing through on the assembly line.

Order holding room.--The order holding room is used for retaining customer and route orders prior to loading them on delivery trucks. Although this facility is desirable for any type of operation it need not exist as a separate room if the order assembly room is held at zero degrees and is large enough for holding orders after they are assembled. In any event, the order holding room should be so located in the plant as to permit efficient handling of frozen foods to and from the storage room, the order assembly room, and the loading docks.

Loading and unloading docks.--Platforms at truck-bed and car-floor height are important for the efficient handling of frozen foods into and out of the plant. For best arrangements there should be a separate dock for unloading, so that the incoming frozen foods can move directly into storage without interfering with the merchandise moving out of the order holding room. In order to facilitate the loading and unloading of products during inclement weather the docks should be under a roof of some type.

Accommodations for refrigerating and parking delivery trucks.--Since many wholesalers are dependent upon the plant's electric current or refrigeration media to keep their trucks refrigerated, it is necessary to provide for these accommodations in designing a wholesale plant. Also, the service life of the refrigerated truck, which is an expensive piece of equipment, can be lengthened somewhat if the vehicles are parked under shelter at night and at other times when not in use. The place for plugging-in the trucks' refrigeration systems can be at the shelter where

the trucks are parked over night. In the event that the trucks are to be loaded while they are plugged-in, the loading platform can be enclosed and used in this capacity.

Equipment.--It is also important in designing a wholesale plant that consideration be given to the type of equipment that is to be used for handling frozen foods in the plant. For example, if the frozen foods are to be palletized in storage, the ceiling should be higher and floor space will be needed for storing pallets and parking fork lift trucks. Also, it will be necessary for doors and platforms to be built wider if plans call for the use of conveyors. If roller or power conveyors are to be used to carry frozen foods to and from the plant and from one room to another, it will be necessary to have small doors in the wall with flexible coverings to prevent undue exposure of the refrigerated room while frozen foods are being moved.

Adequate office space.--Office space should be part of the plant lay-out where possible and the space allotted must be large enough to allow for convenience in performing the regular office work. Where the telephone-sales system is used extensively for selling frozen foods, there should be special arrangements made in the office to accommodate telephone, inventory files, and price files.

Separate compressor room.--It is necessary for a wholesaler to have a separate compressor room when the plant is independent of the public warehouse. This room should be large enough to allow for the expansion of equipment and it is preferable to have it located in a section of the plant where space is not needed for moving merchandise to and from storage.

Inspection and cooking laboratory.--An aggressive firm will maintain a laboratory, even if only a small one, so that the true condition of the merchandise in storage can be continuously ascertained. In addition to using the laboratory as a room for inspecting merchandise, it can be used to very good advantage as a kitchen for experimental purposes in gaining helpful information on the preparation of dishes that will be used in sales promotion.

Utility storage room.--There is a need in every wholesale plant for a small utility room for storing things, such as sales promotion data, office supplies, old records, shipping containers, etc., that are necessary for the operation of the business.

Toilet rooms.--Although toilet facilities may be omitted from the plant if they are conveniently available in a nearby establishment, it is far better that they be incorporated in the plant proper. However, they should be constructed and maintained in such a manner as to meet the most rigid sanitary requirements.

DELIVERY FACILITIES AND METHODS

After frozen foods are transported into terminal distribution centers and go through the various wholesale order assembly rooms, additional transportation facilities are required to deliver them to the ultimate retail, institutional, and industrial trades. The customers of fresh produce frequently go to the market area to inspect and pick up their purchases, but with frozen foods, the terminal wholesaler usually delivers to his customers. Going still further, some retail stores and specialized home-delivery agencies even deliver frozen foods direct to the consumer's home. However, in instances where frozen-food home delivery is a specialized function the facilities and methods used are similar to those of the wholesalers and consequently will not be discussed separately.

The trucks, methods, and facilities, used by these various agencies in delivering to and servicing their customers play an important part in determining the degree of success or failure of their frozen-food business. Customers are inclined to judge the reliability of their local suppliers and the general quality of a packer's brand from the condition of the frozen-food packages when it is delivered.

Methods of Delivery

Before discussing the delivery facilities used by wholesalers of frozen foods it might be helpful to describe briefly the various delivery methods and techniques that are commonly practiced. Methods of delivering frozen foods to the trade are quite uniform in some respects and somewhat different in others. Most firms are essentially service wholesalers in that they deliver their merchandise directly to their customer's place of business. Most of them make deliveries to their regular retail-store customers from two to three times a week. Their institutional and industrial trades are generally served daily. In most cases trucks leave the plant or warehouse between 7 and 9 o'clock in the morning loaded with frozen foods for the day's deliveries. Of course, drivers who have long trips ahead of them may start out the night before and not return at the end of the first day.

Sales Methods

The greatest difference in the methods of frozen-food delivery results from the sales method used by the various wholesalers. There are two principal methods of selling. One is "advanced selling," by which the customer's orders are solicited in advance of delivery. Sixty-nine percent of the wholesalers covered in this survey use this system in one form or another.

The advance type of selling has several variations. The most common, is the use of direct-contact salesmen who personally call on the customers to obtain their orders. However, quite a number of firms take orders primarily by telephone (fig. 68). Some of the wholesalers call their customers regularly, whereas a few depend on the customers to

telephone their orders. Several wholesalers even encourage their more distant customers to mail back their frozen food orders on prepared cards sent out regularly along with the current price list. The other method is to employ "wagon salesmen" who sell directly off the delivery truck at each customer's place of business. Seventeen percent of the firms operate under this method almost exclusively. The remaining 14 percent use a combination of the above two methods.

Regardless of the method used or the type of trade served, one of the initial steps of the wholesaler in soliciting sales is to keep the potential buyer informed of prices. Frequently this price information is disseminated by printed or mimeographed sheets. Price information for the retail trade is usually on a separate sheet from the information for the institutional or industrial trades (fig. 69). Along with the price list to the retail trade, the wholesaler often sends a suggested price at which the frozen foods might be sold to consumers. The purpose of this is twofold. One aim is to encourage the retailer to keep the price of a wholesaler's commodities in line with the prices of other brands; the other is to aid the retailer in deciding what his mark-up should be.



Figure 68.--These women sell frozen foods to retailers and users by telephone, and discuss supplies and availability of items. With this system a pleasing telephone personality is essential.

Time from Sale to Delivery

The period between the time the customer places his order and the time it is delivered varies from a few minutes to a week or so, depending on the type of sales method used, as well as the general operating procedure of each wholesaler. If wagon salesmen are used, the salesman makes up each order on the delivery truck just outside his customer's store or plant at the time of sale and delivery. Under the advanced sales method orders are usually taken 1 or 2 days in advance of delivery. For example, on the first day a salesman will visit customers for soliciting their frozen-food requirements. These orders are then assembled and routed for delivery on the second day and actually delivered on the third. Many wholesalers, however, deliver on the second day all of the orders that were turned in to the order department before noon or some other designated hour of the first day. If advance salesmen are used, they either return to the wholesaler's plant or telephone their accumulated orders before the dead line for making deliveries the next day. A similar system is used by those wholesalers who solicit orders over

the telephone. Of course, the more distant customers who are served less frequently may mail their anticipated requirements several days or a week in advance of the delivery date.

Delivery Routes

A delivery route usually represents a rather definite area of customers supplied from one delivery truckload of frozen foods. Coverage of such routes is usually completed within the normal hours of a working day. However, in some instances, wholesalers with long-distance deliveries have routes that require 2 or more days to cover.



Figure 69.--Typical price lists furnished by wholesale distributors to prospective retail stores and to institutional and industrial buyers.

Types of Trucks Used

Delivery trucks that are used by firms in distributing frozen foods to their customers vary considerably in body design and the extent to which they are refrigerated. During the first few years of frozen-food distribution, most of the industry had no refrigerated trucks of any kind. The wholesalers quite naturally took advantage of the trucks they already owned and delivered the frozen merchandise in the same manner as they distributed their other products. This meant that most deliveries were made without refrigeration. However, many dairy plants were already using refrigerated delivery trucks for supplying their customers with ice cream. Consequently, those who expanded their businesses to include frozen foods, found the ice-cream trucks readily adaptable to delivering both lines of merchandise. In other cases, meat packers, fresh-produce dealers, and wholesalers of fish products had insulated trucks prior to taking on the distribution of frozen foods. These trucks were then used for delivering both the frozen and fresh commodities.

Soon, however, a few wholesalers developed their frozen-food business sufficiently to justify obtaining separate trucks specially equipped for delivering their frozen products.

As the frozen-food industry has continued to grow, wholesalers have constantly placed increasing emphasis on the use of trucks designed solely for delivering frozen merchandise to the trade. According to the survey, nearly one-half of all such vehicles are refrigerated. Another 31 percent are insulated, and in many of these dry ice is used on warm days. However, there still remains 22 percent, or more than one truck out of every five, which are neither refrigerated nor insulated. In a few cases, open stake-body trucks are still in use.

Size of Trucks Used

Most wholesalers use a medium-sized truck of about $1\frac{1}{2}$ ton capacity. Quite a number of them, however, have 2-ton trucks. A few use much larger sizes for distributing to customers 200 to 300 miles distant. Of course, there are also numerous wholesalers whose delivery facilities run somewhat smaller than the $1\frac{1}{2}$ -ton size. Variations of the small types include panel trucks, pick-up trucks with freezer boxes attached, and even conventional automobiles for the small one-man wholesale operation. The home-delivery agencies tend to use the medium-sized delivery trucks; however, some of them use a smaller vehicle similar to the ice-cream trucks common throughout the residential areas of most cities. Retail stores which deliver frozen-food orders to their customers are, for the most part, still using their conventional assortment of delivery facilities.

Number of Trucks

The number of trucks retained by any wholesaler for delivering frozen foods depends largely, of course, on the volume of his business. The most common number found among the wholesalers visited was three trucks.

The wholesalers who either handled frozen foods exclusively or at least deliver frozen products separately also averaged about three vehicles each. Four to five trucks were more common among those who delivered frozen foods along with other merchandise. Taking all types of wholesale distributors together, one-half of those visited were using from three to five delivery trucks; one-fifth used fewer than three and the balance required more than five.

Various Uses of Delivery Trucks

Of course, a wholesaler handling frozen foods exclusively uses his delivery facilities for nothing but frozen merchandise, but as has already been indicated, this is not necessarily true for those wholesalers who handle other products in addition to frozen foods. In fact, about three-fifths of the latter were found to deliver at least a part of their frozen items at the same time they distribute fresh produce, meat, or dairy products, whatever the case may be (fig. 70). One-fifth of these firms deliver frozen foods separately from other merchandise, and another one-fifth use both types of trucks. For example, a wholesaler of fresh fruits and vegetables might deliver both the frozen and fresh merchandise in his regular produce trucks to his institutional customers but provide separate trucks for supplying his retail trade with frozen foods. There are also isolated instances where a wholesaler of frozen foods has no delivery facilities whatsoever. However, such wholesalers generally sell their merchandise to other wholesalers who in turn distribute the frozen foods to the trade. Several firms supplement their delivery facilities by using frozen-food shipping containers in which they pack frozen-food orders and deliver in light-weight insulated trucks or ship them by express.



Figure 70.--Frozen foods are often delivered to restaurants and institutional users along with non-frozen items. In many instances deliveries are made in uninsulated or unrefrigerated trucks.

Design of Trucks Used

It has already been indicated that the design of the trucks used today for delivering frozen foods to the trade differs widely among wholesalers. It is believed, however, that several features observed in the design of these facilities materially influence their performance and efficiency. Among the more important are the arrangement of doors, internal design of the body, and refrigeration facilities.

Arrangement of doors on the trucks.--Small trucks are likely to be restricted to one walk-in type of door which is commonly located at the rear. Also, a few of the larger trucks have only one entrance to the frozen-food box. Wholesalers whose vehicles are equipped with two doors--one at the rear and one on the side--pointed out the greater flexibility of such an arrangement. As an illustration, in the large cities traffic congestion frequently makes it impossible for the driver to complete his deliveries to the hotels and restaurants in the sequence that his orders are loaded. Under these circumstances he can adjust his route and use the side door to remove the orders, intended to be delivered later on the route, closer to the front of the truck.

Many wholesalers, particularly those who sell directly off the truck, have boxes divided into several reach-in type of compartments, as shown in figure 71. A small door is then provided for each compartment, thus limiting the escape of cold air to only a part of the box at one time.

Internal design of truck box.--Wholesalers who put up their frozen-food orders in advance of delivery generally do not use truck bodies that have compartments or shelves. Exceptions exist where the body is divided into two separate compartments--one for frozen foods and the other for nonfrozen items. On the other hand, wholesalers who employ wagon salesmen use various techniques for assorting frozen foods on the truck. Some use a one-room arrangement, with the various commodities sorted by shelves and bins (fig. 72), while others divide the box into two or more compartments. In some cases these compartments are subdivided into shelves.

Means of refrigerating trucks.--Delivery trucks are found to be equipped with several methods of refrigeration, ranging from dry ice placed loosely around the order boxes to portable motor-driven condensing units. Dry ice bunkers and blowers are used by a few wholesalers in their insulated single-room type of truck bodies but seldom are they used where boxes are divided into several compartments. In some instances the dry-ice bunkers are merely holding racks and in other cases they are built similar to holding plates.

The mechanical refrigeration of delivery vehicles is accomplished in several ways. Perhaps



Figure 71.--Some trucks carry foods in compartments which can be reached easily by one of several side doors in addition to the rear door. This arrangement permits flexibility in delivery in areas of congested traffic. The truck shown above has two doors on each side and one rear door.



Figure 72.--Wholesalers who sell frozen foods directly from a truck must have a complete stock of items, arranged in the truck in convenient compartments, so that orders can be filled rapidly.

the most common method is to install holding plates, which, when once refrigerated, keep the delivery boxes at low temperatures for several hours (fig. 73).

Unlike the large transports, the delivery trucks are not often equipped with portable sources of power that keep the refrigerant flowing through the pipes. In some cases these holding plates are refrigerated from a compressor unit on the truck that runs only when it is plugged into an external supply of electric power (fig. 74). However, in other instances there is no compressor unit on the truck but the refrigerant is pumped through the holding plates at night, thus bringing the temperature of the truck down to 0° F. Delivery trucks, mechanically refrigerated by these systems, do not insure constant low temperatures throughout the day's delivery. For instance, one company made some spot checks on several types of refrigerated delivery trucks in use by wholesalers and found temperatures ranging from 0° to $\nearrow 30^{\circ}$ F. The higher temperatures were observed later in the day on trucks that

were refrigerated during the night from external power or refrigerant supply. More uniform low temperatures exist in trucks equipped with a complete refrigerating mechanism.

Factors Which Affect the Use of Refrigerated Delivery Facilities

In an industry so new as frozen foods, there is naturally much to be answered regarding the types of trucks that are best suited to making deliveries under various circumstances. One question to be answered, for example, is why do some frozen-food wholesale distributors find refrigerated delivery vehicles so necessary while others do not? There is need for a great deal of study to determine what

factors should be taken into consideration in deciding which equipment will properly fit a given situation for the best operating efficiency. However, at least four factors are known to influence the use of refrigerated delivery facilities by wholesalers now engaged in frozen-food distribution. These are discussed in the following paragraphs.

Type of business performed by wholesaler in addition to his frozen-food operation.--The nature of the business performed by a wholesaler in addition to the distributing of frozen foods has a distinct bearing on the type of delivery trucks that he uses (fig. 75). Virtually all wholesalers who handle dairy products as well as frozen foods have either refrigerated trucks or insulated trucks. The insulated trucks with the use of dry ice can be held at low temperatures during periods of delivery.

Wholesalers who also handle poultry, fresh fruits and vegetables, or grocery items, use a relatively small percentage of refrigerated trucks in delivering frozen foods. About three-fourths of the wholesalers handling poultry, three-fifths of those handling fresh fruits and vegetables, and two-fifths of the wholesale grocers use trucks that are neither refrigerated nor insulated. Thus, by far the larger part of their merchandise is delivered in vehicles without temperature controls. The poultry wholesalers used the open pick-up type of trucks to deliver live and New York dressed poultry packed in ice to their local customers long before they handled frozen foods. Also, the grocery firms frequently had little or no need for refrigerated or insulated delivery trucks before taking on frozen foods.

It has long been the practice of wholesale meat distributors to use insulated trucks. They have carried this practice over into the handling



Figure 73.--This cut-away view shows how refrigerated plates are installed in insulated truck bodies. Note the 3 plates--one on each side and one in the front of the body.

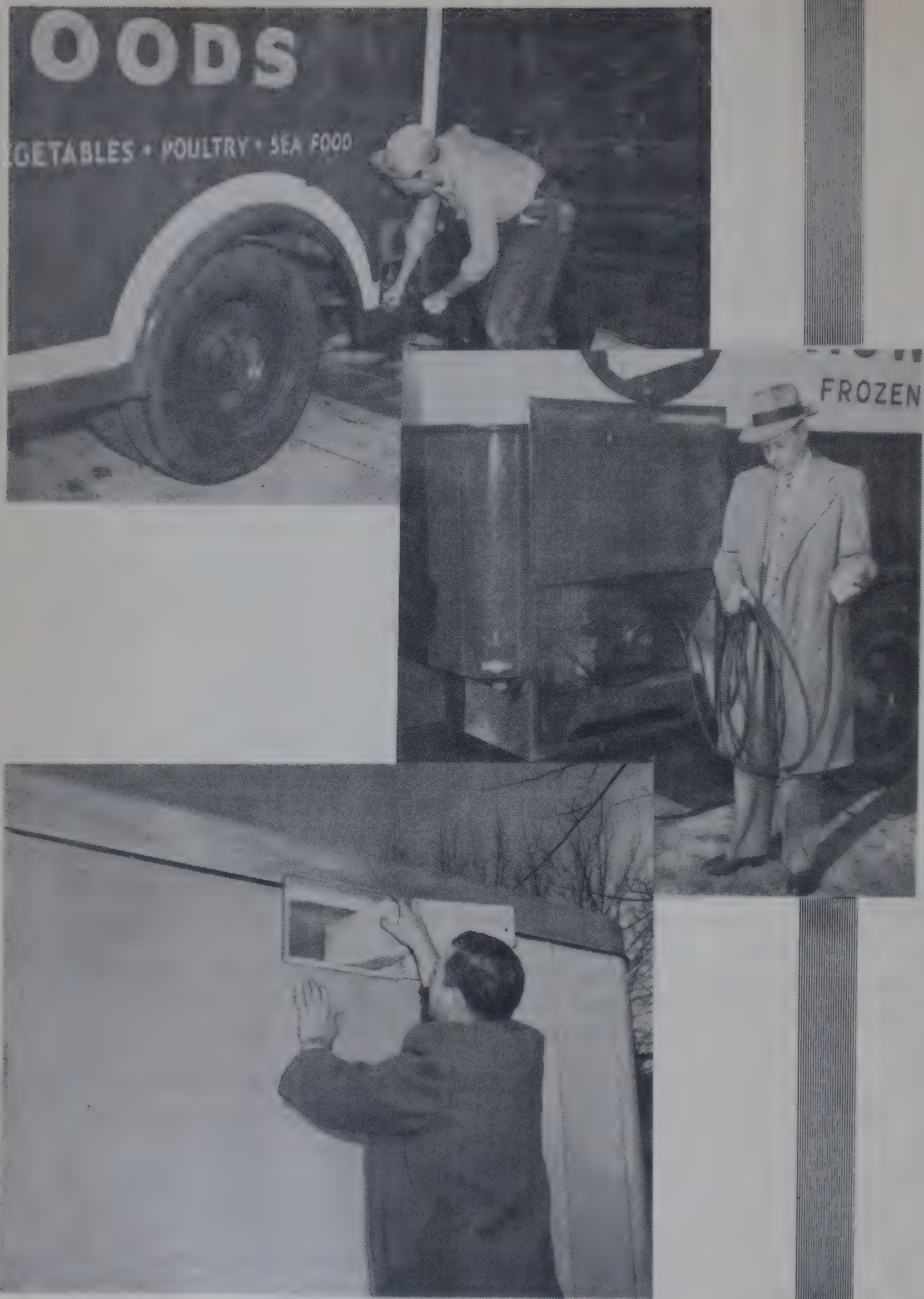


Figure 74.--Three common methods of refrigerating delivery trucks are shown. Coils in some trucks are plugged into the plant refrigeration system when the truck is not on delivery service (top). Some other trucks are equipped with an electrically powered compressor which is operated only when the truck is parked near an electric outlet (middle). Many trucks, refrigerated with dry ice, have bunkers in the ceiling and are iced through small side doors (bottom).

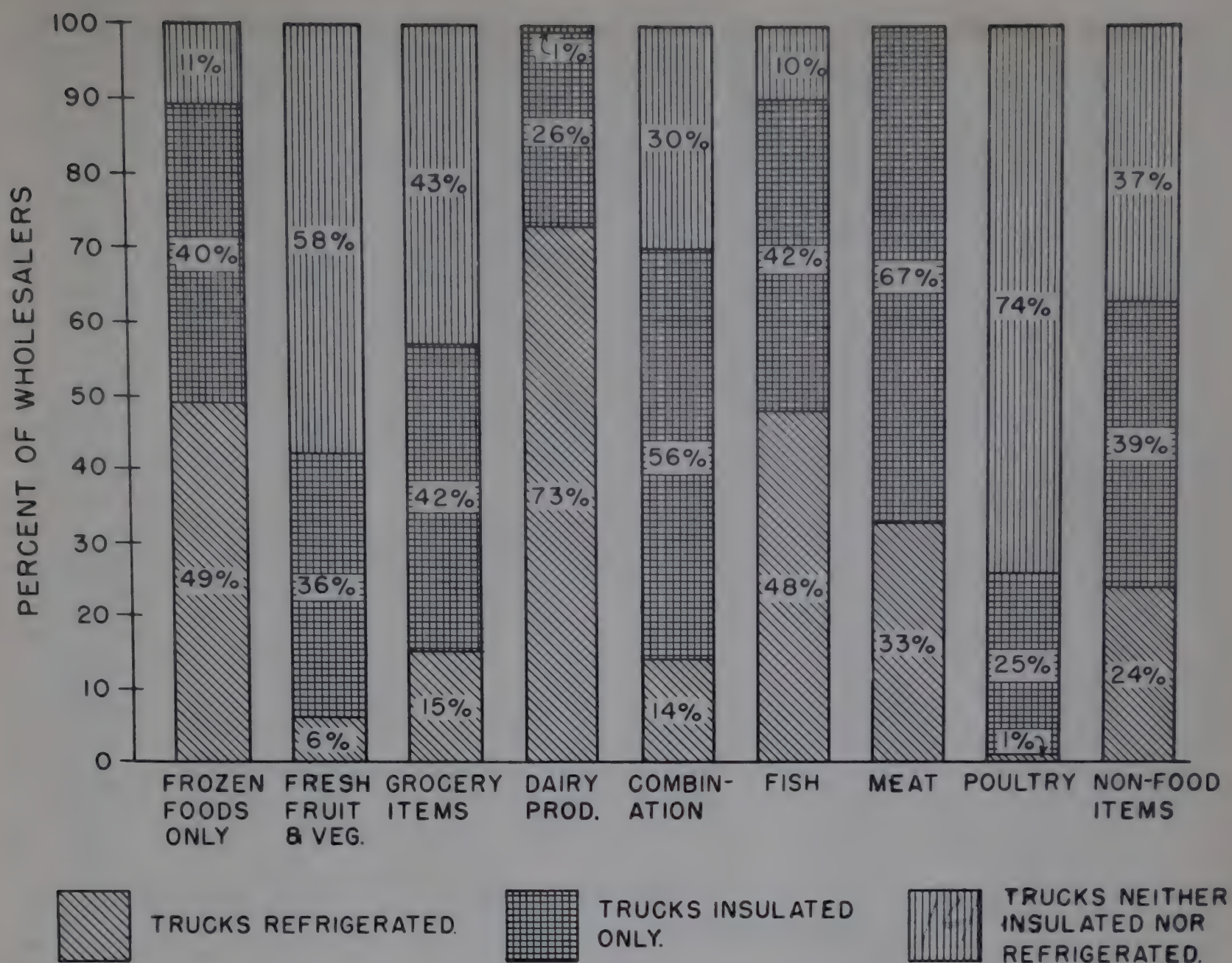


Figure 75.--Percentages of frozen-food wholesalers using specified types of delivery trucks.

of frozen foods, and as a result about two-thirds of this merchandise is delivered in insulated trucks while the remaining one-third is carried in refrigerated vehicles. Where wholesalers handle miscellaneous items, such as beverages and electrical appliances, in addition to frozen foods, the type of truck used varies according to the particular product handled. However, a large percentage of the frozen foods delivered by this class of distributor is transported in trucks without refrigeration.

The type of delivery truck used by those who distribute frozen foods exclusively presents a very interesting study. A large number of these wholesalers started in the business from "scratch" and had no background in distributing foods of any kind. Some had been dry goods merchants, farmers, oil men, cabinet manufacturers, engineers, and returned veterans, with no previous business experience. Obviously these people had no fixed methods of distributing food products. Starting into business under such circumstances they did not have to make use of equipment in which they had capital already invested. They therefore had more flexibility of choice in selecting trucks. Others who handle frozen foods

exclusively but who had previous wholesale food experience, were for the most part subsidiaries of large distribution organizations and, therefore, had sufficient capital to bring into use the equipment that they felt was best suited for the purpose. In selecting delivery trucks, a wholesaler considers primarily how adequately they can perform the service required, and the amount of money that he is prepared to invest in such equipment. Figure 75 also shows that 49 percent of the exclusively frozen-food wholesalers use refrigerated trucks, 40 percent use insulated, and 11 percent use trucks that are neither insulated nor refrigerated.

Type of customers served.--Many wholesalers said that the type of trucks that they use depend to a large extent upon the nature of the trade they serve (fig. 76). More than one-half of the trucks used by wholesalers who cater principally to the retailer are refrigerated. Further, about one-third of the trucks that these wholesalers use are insulated and thus can be held at refrigerated temperatures. On the other hand, nearly one-half of the wholesalers who primarily serve the institutional and industrial trade use trucks that are neither refrigerated nor insulated. A wholesaler who serves both the retail and institutional trade is less inclined to use refrigerated trucks than the suppliers of retail outlets only.

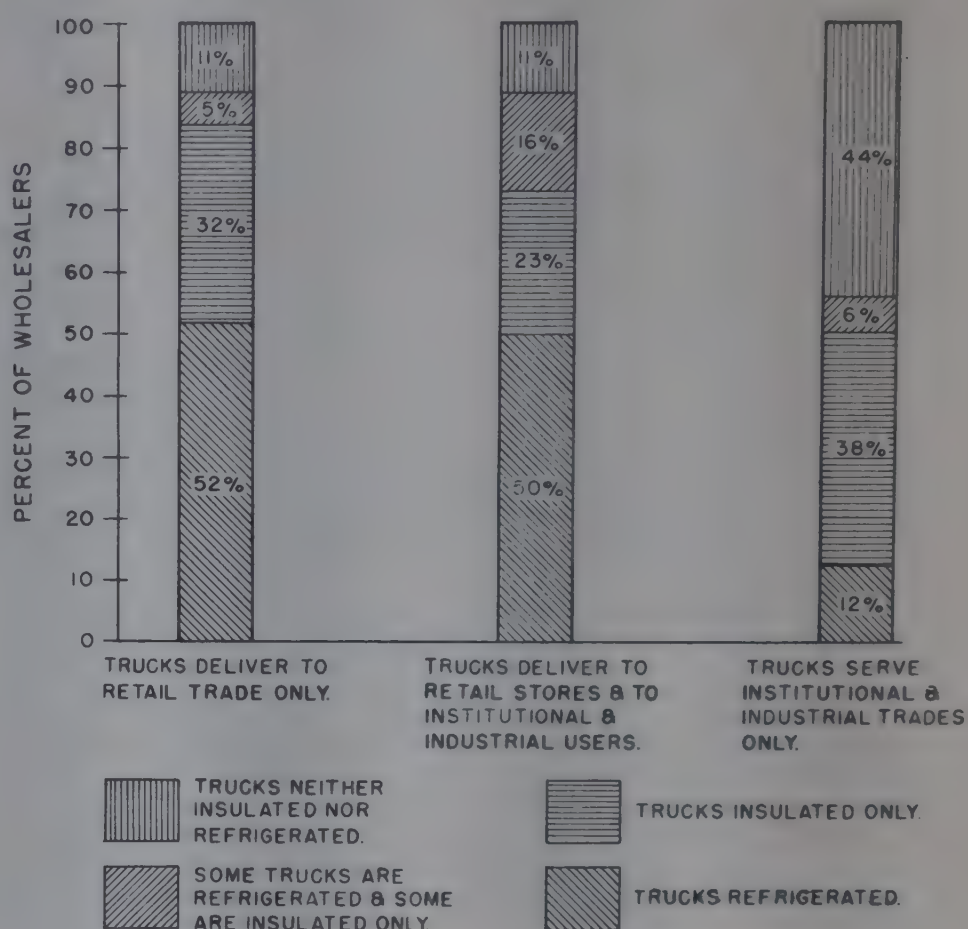


Figure 76.--Percentages of types of trucks used by wholesalers to serve different kinds of trade.

The principal reason advanced for using less refrigeration in delivering frozen foods to the institutional and industrial users than is used in making retail deliveries is that less time is required. Hotels, restaurants, and clubs, are generally concentrated in the heart of the city, thus requiring less time for servicing than the retail stores, which are scattered throughout the city and outlying areas. This is substantiated in figure 77. The survey indicated that 69 percent of the deliveries to the retail trade required from 7 to 9 hours, whereas, 60 percent of the deliveries to the institutional and industrial customers were made in less than 3 hours. However, some trucks loaded with institutional packs of frozen foods are on the road all day without any refrigeration.

Another reason given by wholesalers for using less refrigeration in delivering frozen foods to their institutional customers is that much of this merchandise is in large containers which will be used shortly after delivery. Therefore, even if the frozen food is partially defrosted by the time it gets to the customer, many believe this in no way affects the final quality of the product.

Time required for delivering frozen foods.--The relationship between the time spent in delivering and the extent to which refrigerated delivery trucks are used is shown in figure 78. Nearly one-half of the wholesalers who completed their deliveries in less than 3 hours use trucks which have no means of temperature control. Slightly more than two-fifths of them use insulated trucks, whereas only a very few use refrigerated trucks.

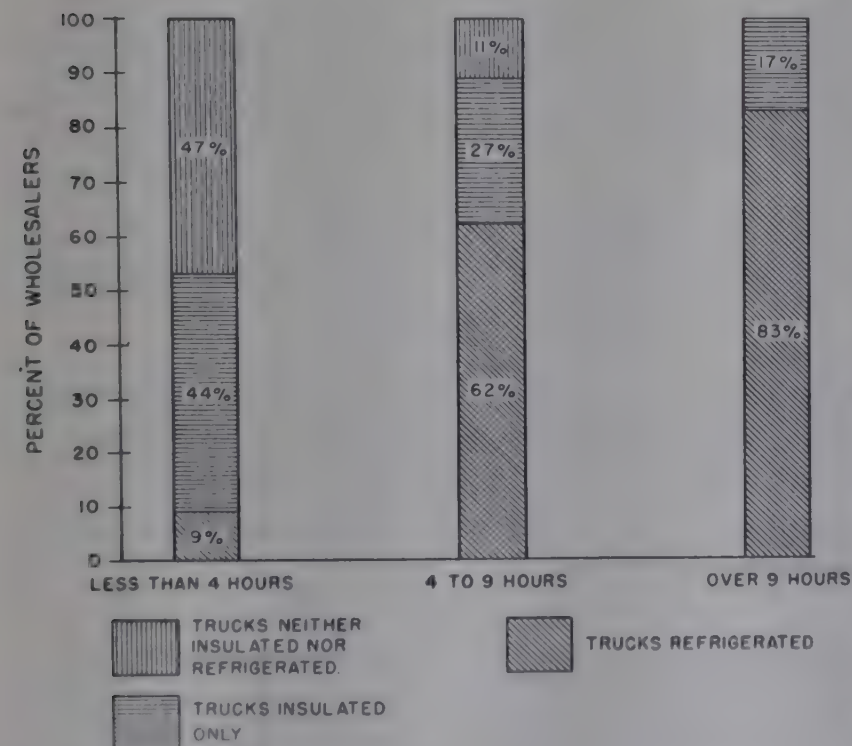


Figure 78.--Relation between time spent on delivery and the use of refrigerated trucks.

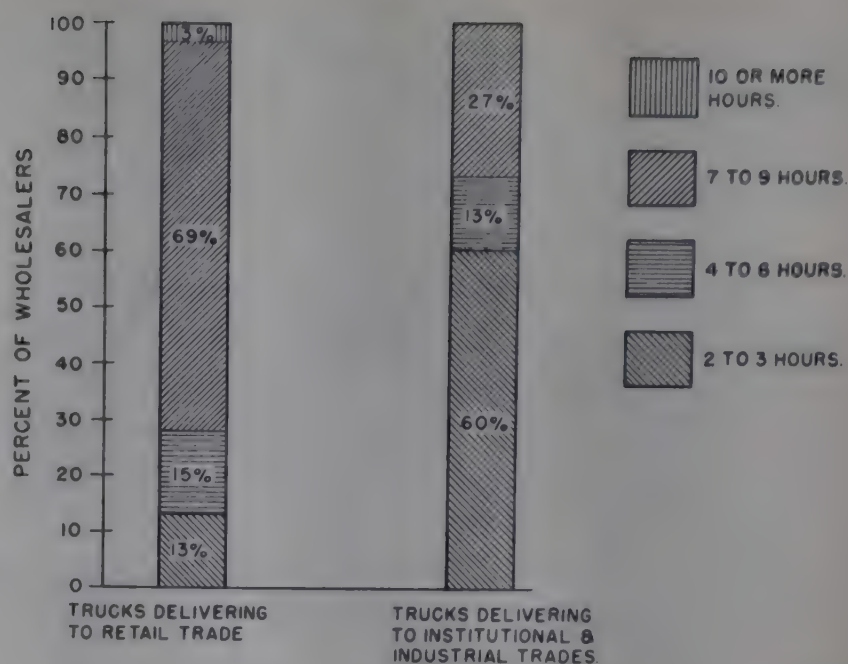


Figure 77.--Number of hours spent in delivering frozen foods to retail, institutional, and industrial trades.

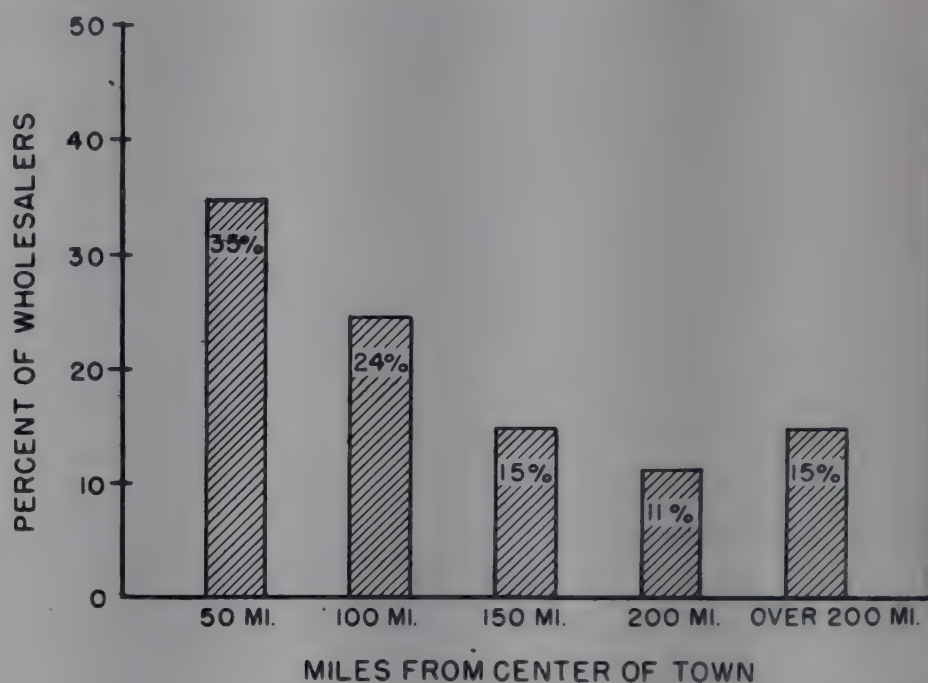
Sixty-four percent of the wholesalers use refrigerated trucks when they are out from 4 to 9 hours. Twenty-six percent have insulated trucks, while 10 percent of them still use facilities with no means of temperature control, except for the occasional use of dry ice. Most of these wholesalers keep their delivery trucks out for a full day, namely, 7 to 9 hours. Some of the firms who use insulated trucks on their full-day delivery routes feel that their frozen merchandise is delivered in good condition. Although this is probably true, in many instances it has been observed that frozen foods delivered in insulated trucks without sufficient dry ice have reached outlets partially thawed.

Eighty-six percent of the wholesalers whose delivery routes last for more than 9 hours use refrigerated trucks. The rest have insulated facilities. Of course, some of those with insulated equipment make limited use of dry ice, while others count on relatively

cool air during their overnight hauls to keep the merchandise from defrosting. Thus, as the length of time spent on the delivery routes increases, greater use is made of refrigerated trucks and a corresponding decrease in the use of vehicles that are only insulated and those that are neither refrigerated nor insulated.

The greater the area served by a wholesaler, the longer his trucks are apt to be on the delivery route. In all the cities visited a wholesaler's local delivery route covers a radius of at least 5 miles from his place of business. Over two-thirds of the wholesalers serve customers who are 15 miles or more from his headquarters. A few deliver their frozen merchandise to stores up to a 50-mile radius on their local routes. These local deliveries are not a part of the wholesaler's out-of-town deliveries, since these longer distances are usually covered with separate trucks.

Figure 79 includes those wholesalers who provide out-of-town deliveries. About two-thirds of them go farther than 50 miles and the other one-third restrict their hauls to shorter distances. Fifteen percent make deliveries past the 200-mile radius. Many trucks that deliver to areas more than 50 miles distant must spend more than an 8-hour day en route. As can be seen in figure 79 most of these trucks are refrigerated and the balance are at least insulated.



(Includes all methods of delivery, but consists mostly of distributor-operated trucks, with some express shipments.)

Not only are the customers more concentrated in large cities, but the heavy traffic congestion also materially affects the time a truck is out on the delivery route. As an example, in New York City a deliveryman spent 3 hours from the time he left the wholesaler's plant until he returned when delivering orders of frozen and fresh foods to only six institutional customers--all located within a mile of each other.

Figure 79.--Radius of out-of-town deliveries of frozen foods made by wholesale distributors.

Sales methods.--The type of sales system used by the frozen-food wholesalers materially influences the number of customers serviced in a given period and the use of refrigerated delivery facilities. According to the survey, nearly 82 percent of the wholesalers using wagon salesmen were equipped with refrigerated delivery facilities and the remaining 18 percent used insulated trucks. On the other hand, only 37 percent of those using advance sales methods had refrigerated

delivery equipment. Thirty-five percent used insulated trucks. Thus, slightly more than one-fourth of the advanced sales type of wholesalers used no means of refrigerating their trucks. A few of these firms, however, reported that they use dry ice for deliveries on very warm days.

Wholesalers are more inclined to use refrigerated facilities when they sell directly off the delivery truck, for two reasons. First, the doors on the wagon salesman's truck are open a greater part of the day, thus exposing the frozen foods to outside temperatures more than is necessary on the direct-delivery trucks. Second, those using wagon sales method tend to be on the delivery routes for a longer period.

When the customer's frozen-food requirements are solicited by advance salesmen, the completed orders are usually loaded in the delivery trucks according to the sequence of stops along the routes, so that the last order loaded on the truck is the first one to be delivered and so on throughout the day. Then, at each stop the driver needs to open the door to the frozen-food box only long enough to remove the customer's order from the truck. Deliveries made by the wagon salesmen are not quite as simple. He must ascertain the customer's frozen-food requirements before he knows what commodities to remove from the truck. If the delivery box is divided into several reach-in type of compartments, the wagon salesman might have to open several doors to fill the order. Thus, one or more compartments are exposed to the outdoor temperatures while each customer's order is being assembled. Even if the truck only has a single door, there is a tendency for the salesman to make several trips in and out of the truck. Obviously, the more frequently these doors are opened and the longer they remain open, the more difficult it is to keep the frozen foods in the trucks at proper temperatures.

In regard to the length of time spent on the delivery routes, 86 percent of the wagon-sales type of wholesalers keep their trucks on the routes for more than 7 hours. In contrast, only 45 percent of those who use the advance sales have delivery trucks out this long. However, wagon salesmen average fewer stops per day than do the regular drivers of straight delivery trucks. Figure 80 shows the number of stops normally made in a day by the wholesalers visited. Although the number ranged from less than 20 to well over 100 stops in 1 day, nearly

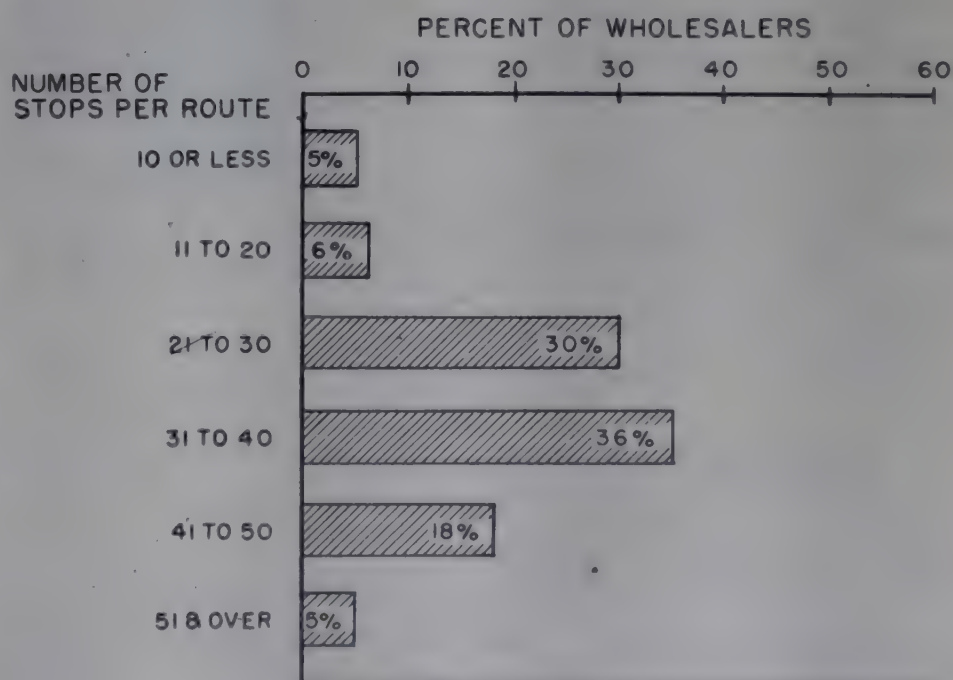


Figure 80.--Number of delivery stops per route made by wholesale distributors.

two-thirds of the wholesalers made between 20 and 40 stops. It is estimated that the wagon salesmen averaged between 25 and 30 per day as compared with about 35 stops for the direct-delivery truck driver. This is not surprising when you consider that the wagon salesman has to obtain an order from the customer at each stop before he can unload the merchandise. Naturally, he occasionally visits a potential customer who does not make a purchase. The direct-delivery truck, on the other hand, needs only to stop where the frozen foods have previously been ordered.

Ownership of Delivery Facilities

A majority of the frozen-food wholesalers own their delivery trucks, but many firms rent their trucks and question the need for owning them. Reasons advanced for renting are: (1) Renting trucks eliminates capital outlay for purchasing trucks; (2) firms that rent have no truck maintenance expenses; (3) renting trucks reduces hidden or unexpected costs of delivery; and (4) renting affords flexibility in the number of trucks required daily or seasonally according to volume of business.

Frozen-Food Shipping Containers

Frozen-food shipping containers have come into use largely as a result of the various limitations of refrigerated transportation facilities for moving relatively small quantities of frozen foods. Commercial frozen-food agencies, common carriers, express companies, and private individuals have found certain sizes of these containers, or "shippers," as they are called, adaptable to their particular requirements.

Shipping containers that are now in use range in capacity from twenty to several hundred pounds. A few wholesale distributors used these containers to deliver frozen foods along with their unfrozen merchandise in light-weight uninsulated trucks, as shown in figure 81. Others use them for shipping orders of frozen foods by common carrier to customers at more distant points under circumstances where the volume of business would not justify the cost of running a delivery route that far. Some wholesalers cater to a specialized trade and use these containers to ship their products to all parts of the country. Frequently containers are sold outright to the users.

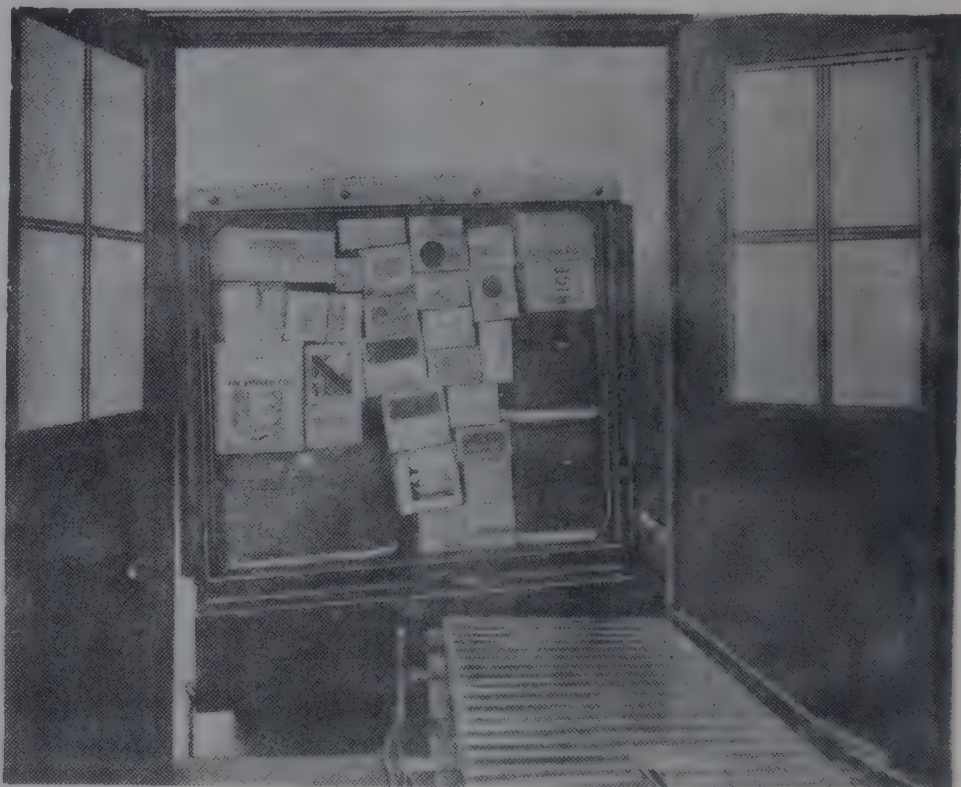


Figure 81.--On out-of-town hauls, frozen foods are often put into insulated containers and loaded onto trucks with dry grocery items. If trucks are out for long periods, dry ice is usually placed in the containers with the frozen foods.

The Railway Express Agency has used special containers for shipping small quantities of perishable foods for several years. These are large insulated metal boxes and are equipped with dry-ice bunkers for shipments of frozen foods. The bunkers fit into the cargo space and hold up to 100 pounds of dry ice. These containers provide 10 to 12 cubic feet of storage space for shipments weighing from 300 to 400 pounds. Of course, if frozen foods are to be shipped long distances, storage space must be sacrificed for larger dry-ice bunkers.

The special containers are neither sold nor rented. Rather, they are retained by the Railway Express Agency, Inc., and are at the disposal of any express station that has a request for a shipment of frozen foods in less than carload lots. The tariff rates are based on the net weight of the shipment, with a minimum of 350 pounds. A service charge of \$4 is made on shipments up to 48 hours in transit, plus 50 cents for each additional day of shipping time. Twenty-four hours free time is allowed for loading and unloading. When the consignee is through with the container, he notifies the Express Agency to claim it.

Insulated shipping containers also are used for storing fresh or frozen perishable foods where refrigerated facilities are not available. Some consignees are willing to pay an additional fee for holding the container as a refrigerated storage unit until the frozen foods are used.

Some insulated containers are adapted for use on hunting and fishing trips. Sportsmen pack them with frozen foods or even with complete meals for eating at camp, while on the return trip they may pack them with fish and game.

Another use for the frozen-food shipping containers is in air transportation. For example, shipments of choice seafoods are packed according to the anticipated temperatures and duration of the trip and shipped by air express or in air-cargo planes across the country. In June 1948, a container filled with frozen foods and refrigerated with dry ice was flown from the United States to Colombia, South America. The temperature of the frozen foods upon arrival was reported to be 5° below zero.

RETAIL FACILITIES

It is estimated that about 56 percent of all commercial frozen food is distributed through facilities at the retail level. The other 44 percent reaches the consumers by way of the institutional and industrial trades. Of the 56 percent going to consumers in retail-size packages, it is estimated that by far the larger part is marketed through retail stores. The remainder reaches the home by means of house-to-house delivery service and by way of locker plants. In view of the fact that selling frozen foods through the retail grocery store is a comparatively new development in the industry and also taking into consideration how relatively little the possibilities of such outlets have been exploited, it is believed that herein lies a great potential field for increasing outlets for farm products. The growth and expansion of frozen foods, especially in the immediate future, depends to a large extent upon how they are presented to the public at the retail outlets.

Types of Retail Stores

For the purpose of this discussion food retail stores are divided into three general classes: (1) The supermarket; (2) the small neighborhood grocery; and (3) the frozen-food specialty store.

The supermarket.--The supermarkets as they are known today appeared on the American retailing scene only a little more than 10 years ago, but as most food shoppers know, they are now institutions that are unique in the annals of food merchandising. It is not known how many of these large shopping centers are carrying frozen foods, but observations made in 50 of our largest cities indicate that well over 50 percent of them have frozen-food cabinets. This self-service type of store is a "natural" for frozen foods, and the small, compact frozen-food package is well adapted to the self-service system. Also, because these stores operate on large volumes and on a cash-and-carry basis they are in a better position to offer frozen foods at a lower price than the small salesman-service stores.

The small neighborhood grocery.--The neighborhood general grocery store has long been a fixture in every American community. These stores are particularly valuable for consumers within a community who make small spur-of-the-moment purchases; on the other hand, shoppers in some areas use them for making sizable purchases. Also, they are about the only remaining retail food establishments where consumers can establish charge accounts and from which consumers can have foods delivered to their homes. The methods of sales used by the small neighborhood stores are somewhat different from the method practiced by the supermarkets. In these neighborhood stores the foods are primarily sold by a store clerk, usually the proprietor, who waits on the customer. With this type of system the display ability of the frozen-food cabinet is not as important as it is with the self-service system.

The number of neighborhood grocery stores is far greater than the number of supermarkets, but the indications are that the proportion of neighborhood stores that have retail frozen-food cabinets on their premises is less than the proportion of supermarkets having them. However, the

existence of the neighborhood grocery stores in large numbers, their large aggregate volume of business, together with their nearness to the consumer, set them up as strong potential outlets for frozen foods.

The frozen food specialty store.--Frozen-food specialty stores exist as independent retail establishments and as sections in department stores.

The history of the independent specialty store presents a rather interesting story. During and shortly after World War II, these specialty stores came into existence almost overnight. Although their growth was widespread, they became relatively more abundant in the metropolitan areas. Their existence was possible because of the short supply of foods in relation to the tremendous demand. Frozen foods were obtainable by merchants when other food were not, and consumers were buying almost all kinds of food on the market. When the Nation's food supply began to adjust itself after the war, these stores found themselves in a position that from an economic standpoint was not so favorable, and the consequence was widespread business failure. In the recent survey of 50 cities, it was revealed that there were only a very few frozen-food specialty stores still in operation.

In all successful cases observed, the frozen-food specialty store was dependent on some other products to round out the business. In some instances, appliances, particularly home freezers, were used as the supporting factor. In other cases, home-delivery service was conducted in conjunction with the operation of the store. Most of the stores, however, carried multiple food products, and in a strict sense were actually independent grocery stores that were featuring frozen foods. Two or three of these multiple food establishments were outstanding in their technique of operation. Actually these establishments were retail self-service food stores that had all of the perishable and staple commodities built around the frozen-food section. Perishable and staple commodities were presented in such a way as to supplement or serve as a complement to a full line of frozen foods. Cabinets used were, for the most part, of the open type and were so placed as to attract attention when customers first came into the store. Managers of these stores indicated that business was good and it was their belief that theirs was the store of the future. Plans were being laid by these operators to expand their facilities.

Although two of the larger self-service stores were procuring a considerable amount of their frozen merchandise from packers or brokers, most of these specialty stores received frozen foods from local wholesale distributors.

In the last 4 or 5 years a number of the Nation's leading department stores have added frozen-food retailing to their selling activities. These frozen-food sections usually combine the retail section in the store with a home-delivery service and at the same time associate both with the sale of home freezers. In this respect they combine the functions of a retail specialty store, a home delivery agent, and an appliance dealer. The joining of these various sales and services has certain advantages, but perhaps the biggest advantage lies in the application of some of the

established principles of department-store selling to the retailing of frozen foods. For example, they can easily extend their charge account system to cover frozen-food sales. Through the sale of frozen foods they can enhance the sale of home freezers and vice versa. Their organization is well adapted to educating the consumer on the use of frozen products, and with their large financial support they can afford to make long-range plans for expansion of their frozen-food business.

The actual retail section of the department store operates just about the same as any specialty store would, except that nonfrozen foods are usually not carried as a supplement (fig. 82). Similarly, the home-delivery operation is conducted about as any other agency would perform it.



Figure 82.--Many large department stores feature retail frozen-food sections that offer a complete line of frozen foods and are usually located adjacent to the home-freezer sales department.

Home Deliveries

The development of home deliveries of frozen foods closely paralleled that of the retail specialty store. At the end of World War II, this service was coming into existence all over the country. As could be expected, the system depended on people "living" out of their home freezer cabinet, and there were only a handful of American homes that had this

required zero storage space. Too many companies entering the field and competing for the space of too few cabinets resulted in the inevitable--many business failures. The idea of home delivery had merit but because of the shortage of home freezers and the high cost of this service in relation to the small sales volume the system did not work so well. Consequently, many of these enterprising businessmen made a hasty retreat from the field. The survey of the country did reveal, however, that a few delivery organizations are operating successfully.

Of the 50 cities surveyed in the United States there were only 18 house-delivery services of any consequence in existence. This does not account for the few retail grocery and frozen-food specialty stores whose house delivery service is merely incidental to their main operations. Nor does it include a few wholesale distributors whose home deliveries are negligible as compared with their wholesale business. Of the 18 recognized establishments participating in house delivery, 9 were department stores, 3 were ice-delivery companies, 1 was also a wholesale distributor, and the other 5 were specializing in home delivery with a retail frozen-food specialty store as a supporting function. In most cases the home-delivery services are operated in conjunction with home freezer sales. The offering of the necessary appliances contributes to the building up of the frozen-food business. The aim is to get freezers into the home and then service them with frozen foods. Some operators rent the cabinets, hoping eventually to convert the rental to a sale. Other concerns do not rent at all but sell outright to consumers. Home-freezer rental, however, involves a large outlay of capital and the responsibilities of giving technical service to the cabinet. The usual rental fee is about \$2.50 or \$3 per month. In some cases the renter can apply this against the purchase price if he buys the freezer.

In recent years, some companies in the delivery services have been taking orders by telephone. The company will compile a list of homes in the town or neighborhood that have home freezers, plus the names of potential customers that have refrigerators with frozen-food storage compartments. Then, these holders of zero space are solicited by telephone periodically, usually weekly, for their orders. These orders are delivered on regular routes, similar to the type of route delivery practiced by wholesale distributors. However, it is the exception rather than the rule for home-delivery agencies to sell at a price lower than the local retail store. This is true because in most cases the agency receives its supply from the local wholesale distributor and thus operates on a price mark-up basis that is equal to that of the retail store. Whenever home-delivery organizations become stable and large enough in volume to buy a full line of frozen foods in carlots and can efficiently deliver these foods to the home in substantial quantities, they may possibly be able to charge lower prices to consumers thus served than are charged at the usual retail store. This should be especially true when the consumer purchases in case lots.

The primary function of the home-delivery agency is service. Most of these agencies are in a good position to broaden these services to include guidance to the housewife in various ways to use frozen foods. Those firms that have been successful in the field of home delivery have, for

the most part, concentrated on serving the people in the upper income brackets and in serving those families where both the man and wife are employed.

The requirements for the successful operation of a home-delivery service as listed by members of the trade include these factors: (1) Study the area to be served as to home-storage facilities, income, eating habits, and general attitudes on frozen foods; (2) avoid door-to-door selling and set up a delivery route system whereby customers are contacted and their orders taken in advance of delivery; (3) have a minimum number of pounds per customer that will at least cover the approximate cost of delivery; (4) either sell home-freezer units directly or have a working relationship with a local appliance dealer; (5) allow price discounts for quantity buying, thus giving the consumer an advantage over the usual retail price for the same product.

Home delivery of frozen foods offers a challenge to present methods of distribution. If the system is properly applied it may aid the development of the frozen-food industry. In the past decade the idea has developed that the greatest advantages of frozen foods are realized when held in the home in large quantities. The coming of the frozen-food home storage cabinet has given impetus to this idea.

Expansion of Retail Sales

In spite of the potentialities of the house-delivery service, the immediate future of frozen foods depends upon the job done at the retail store. In this respect there are two avenues open to volume expansion: (1) Expanding sales through present retail outlets; (2) increasing the number of retail stores handling frozen foods.

Expansion in present outlets.--Expanding sales in present outlets is primarily a combination job of merchandising, consumer education, and competitive pricing. However, going hand in hand with good merchandising is the necessity for good retail frozen-food cabinets. Selling frozen foods at the retail store demands adequate short-term storage and display cases. This need for proper facilities is more urgent than for other food products sold at retail. A good frozen-food cabinet must perform two major functions. First, it must maintain the quality of the product by affording the proper temperature and humidity environment; second, the cabinet must aid in merchandising through adequate and enticing display.

Open cabinets that will attract purchasers often do not afford the product proper protection against high temperatures. A frozen-food distributor reports that a survey of frozen-food cabinets in more than 150 retail stores showed that 97 percent of the cabinets had temperatures of over 0° F. and 25 percent had temperatures above 20° F. Such high temperatures are undesirable even when the frozen food is in the cabinet for only a short time. However, under these adverse conditions, if the product turn-over is fast enough injury to the frozen foods can be minimized.

If the retailer is to do a good job of merchandising frozen foods he must first of all adhere to at least these five practices: (1) Keep

the frozen foods in the best refrigerated facilities available so as to maintain product quality and yet not sacrifice features in a cabinet that will induce customers to buy; (2) place cabinets in the store so as to take advantage of consumer traffic; (3) make sure that the cabinets and surrounding displays are attractive; (4) arrange the contents so that they are easily accessible with a minimum of stooping and digging; (5) arrange the frozen foods and mark their prices so that the customer can easily associate the price with the package.

By far the most apparent deficiencies of retailing found on the recent survey were the failures to display prices conspicuously. About three-fourths of the 250 retail stores visited in 50 cities failed wholly or in part in this one respect. In most of these situations, the purchaser had to choose between asking the price, buying without knowing the price until she was ready to pay, or refraining from buying the item considered.



Figure 83.--Many frozen food retail cabinets are designed so that customers find it difficult to locate the particular product they desire.

In placing the cabinet many stores have little or no regard for establishing a complementary or supplementary relationship between the frozen and the unfrozen foods. Several stores, however, had developed their merchandising facilities so that the physical relationship of frozen and unfrozen foods offered the consumer optimum conditions for choosing. These stores, were for the most part, of the well defined self-service type that carried a complete line of prepackaged frozen and unfrozen perishables. In many of the smaller retail stores, cabinets were placed in such positions on the floor that they were not conspicuous. Many of the larger stores as well as some of the smaller ones had cabinets that because of construction or upkeep made it necessary for the customer either to dig for packages, or caused her to shy away from the cabinet altogether.

As far as facilities are concerned, the expansion of frozen-food sales in existing retail outlets depends on obtaining more and better cabinets and for a better sales-producing arrangement on the floors of the retail stores. Although some retailers have shown that the initial cost of cabinets can be amortized within a few months after installation, the question arises as to the relative value of the floor space allocated to the frozen-food section. Sometimes the addition of frozen-food cabinets necessitates the decreasing of space devoted to the display of staple and unfrozen fresh foods. Some retailers who have kept records on frozen-food sales have shown that the space devoted to the cabinet yielded more returns per square foot than when the same space was used for other

products. Also, when space has been converted to frozen foods, savings have been shown in man-hours per sales dollar, especially where a complete line of frozen foods were carried. In contrast, information gathered on the survey shows that some retailers had experienced results that were not in accord with the above findings. These conflicting views indicate that more conclusive information is needed to determine how the addition of frozen-food facilities to a retail operation influences space utilization and returns on investment. One question that needs answering is how much of the store's facilities should be devoted to complete self-service of frozen and other prepackaged foods.

Some retailers have profitably employed hostesses to aid in merchandising at the frozen-food counters.

Increasing the number of retail outlets.--There have been numerous estimates as to the proportion of the approximately 494,500 retail food stores in the United States ^{14/} that are handling frozen foods. These estimates vary usually from ³⁵ to 65 percent, because of the different concepts as to what constitutes a store that handles frozen foods. Although some stores carry a full line of frozen foods in well-stocked cabinets, others handle them only occasionally or merely keep a few packages of the leading items in closed cabinets that are used mainly for ice cream. In any event, the outlets for frozen foods can be broadened considerably by bringing into the realm of distribution the numerous independent grocers and local and regional chains that have not yet added facilities for merchandising these products. As more stores handle frozen foods, the sales volume of the industry will naturally be increased. The expansion of frozen food used, however, is not dependent on the number of retail outlets alone, but rather in getting the products first into those stores that have the largest annual sales.

The question arises as to why numerous retail stores have not taken on frozen foods. Because the answers are many and varied, it is not possible categorically to present them. However, a few of the most common reasons are: (1) Many stores located in rural and rural-urban communities are out of reach of the wholesale distributors; (2) the initial cost discourages the purchase of a storage and display freezer cabinets; (3) many stores lack enough floor space for a frozen-food cabinet unless they eliminate other products; (4) in some areas consumers are not yet "frozen-food minded" and the store proprietor feels that sales would be a long time in reaching profitable proportions; (5) many retailers believe that frozen food marketing and especially the marketing facilities at the retail level, have not been thoroughly developed, and prefer to wait until some of the retail distribution problems have been solved; (6) some retailers are just plainly "old-fashioned" and cannot accept any changes in the marketing pattern until these changes are forced upon them.

^{14/} Department of Commerce, Office of Business Economics, Business Structures Division (346,500 grocery stores - with and without meat, 34,200 fish and meat stores, and 113,800 other food stores).

Some grocers are anxious to learn about the factors involved in adding facilities that are necessary for frozen-food retailing. Some of the more important questions as yet unanswered are: (1) Under what conditions will a retailer find it profitable to install a frozen-food cabinet? (2) when it is to a retailer's advantage to add frozen-food facilities, how much should be added and what plans should be made for future expansion? (3) where should the cabinet be located with respect to unfrozen and staple products? (4) what arrangement should be made for storing reserve supplies; should this be a function of the wholesaler, should the display cabinet be used for this purpose, or should another unit be used? (5) what class of shoppers, particularly with respect to income, should be catered to in order to get the best results? (6) how can a retailer get started on a trial basis; who is going to supply the cabinet and on what basis?

The question of facilities for storage of reserve stocks on the premises of the retail store presents a problem for solution. Observations in the retail stores reveal that this angle had not been given much consideration. In a few situations, retailers have installed walk-in freezers in a section of the regular storage room. In other cases, retailers had old chest or wall freezer cabinets placed in the general supply room for holding small quantities of reserve supplies. A few large chain companies keep reserve supplies at the local company warehouse, or at a public cold-storage warehouse. For the most part, however, retailers had no facilities for frozen foods other than the display cabinet.

Where the cabinet space is sufficient in relation to the volume of business to serve as a short-term storage, additional reserve space on premises is not needed; but stores that have a large volume of business will need some on-premise freezer storage other than the display cabinet. If such a store does not have extra storage space it will be necessary for the wholesale distributor to replenish the cabinet almost daily.

Retailers who have provided freezer storage space in their stores have found this arrangement very satisfactory. Of course, wholesalers find it to their advantage to deliver in case lots once a week only rather than more frequently. There is need for further inquiry to determine the effect on the cost of distribution that will result if the retailer assumes more of the storage function.

Cabinet Design

It has been said that there are almost as many types of retail cabinets as there are retail stores handling frozen foods. Although this statement is exaggerated, it, nevertheless, emphasizes the point that there are many variations in cabinet size and design. The number of firms manufacturing cabinets for handling frozen food at retail was estimated in 1948 at 61. ^{15/} Most of these firms have several cabinet models and

^{15/} Refrigeration and Air Conditioning Directory, 1948, Business News Publishing Company, Detroit, Mich.

some use different trade names for extremes in design. A few cabinets of the walk-in and reach in type are built primarily for storage with little regard for merchandising display.

Cabinets used for selling purposes are of two general classes insofar as structure is concerned: (1) The chest-type cabinet (fig. 84), and (2) the vertical cabinet (fig. 85). By far the largest number are the chest type, which is further subdivided into "closed" and "open" types. Except when the lids are open or removed, the closed chest-type cabinets give the appearance of a storage box, and afford little or no visibility of the contents. Variations of the closed type consist of cabinets with



Figure 84.--Chest cabinets of the open type, shown above, provide good visibility of the product and are well adapted to self-service.



Figure 85.--Vertical cabinets of the self-service battery type aid shoppers by displaying available frozen foods with their corresponding prices. As a compartment supply becomes exhausted a small light above the cabinet signals the retailer who replenishes it from the storage section at the bottom of the cabinet.

-- lids that are fixed or removable, transparent or non-transparent, and sliding or hinged. The chief difference between the closed and the open cabinet is the degree of visibility of the products. Naturally the line of demarcation is not at all rigid. Visibility in the open cabinet is attained by displays above it through the use of pictures, of mirrors, or by having the cabinet so designed that the packages will be visible through the side walls.

The vertical retail cabinet of the reach-in type is in use only in scattered instances, but some models are becoming very popular. This is because it has several advantages. In the first place it seems better adapted for dispensing operations. Then, too, use can be made of vertical space instead of valuable floor space. Better

product accessibility has often been mentioned as an advantage and although this is somewhat debatable, it is generally easier to maintain product identity and orderliness in the vertical cabinet. A factor that has put this type of cabinet in the minority has been its relatively higher purchase price, and some believe it costs more to operate. This is because air at 0° F. is heavier than air at room temperature, by the ratio of about 15 to 11; therefore, freezers that open vertically "spill" more air out than other types do when opened. Manufacturers are making much progress, though, to minimize such losses of refrigeration. On the other hand, the chest-type facility as now developed utilizes the inherent advantages that cold air has of being heavier than warm air. Thus, the lid can be left off for self-service purposes without much loss of refrigeration.

Location of Frozen-Food Cabinets in the Retail Store

The location of the frozen-food cabinet in the retail store varies from one store to another. In small stores that are a combination of self-service and salesmen-service, the cabinet is frequently placed near the center of the store or near one of the walls away from the counter. Usually the proprietor puts the cabinet wherever its size and shape will fit. In the large self-service stores the placing of the cabinet frequently depends on whether its supervision falls under one of the other departments, or whether it is treated by the manager as a separate section. For example, if frozen-food sales are handled by the man who is responsible for the sale of fresh fruits and vegetables, he will likely have the cabinet placed in the general vicinity of the fresh produce racks (fig. 86). If, on the other hand, the grocery section supervisor

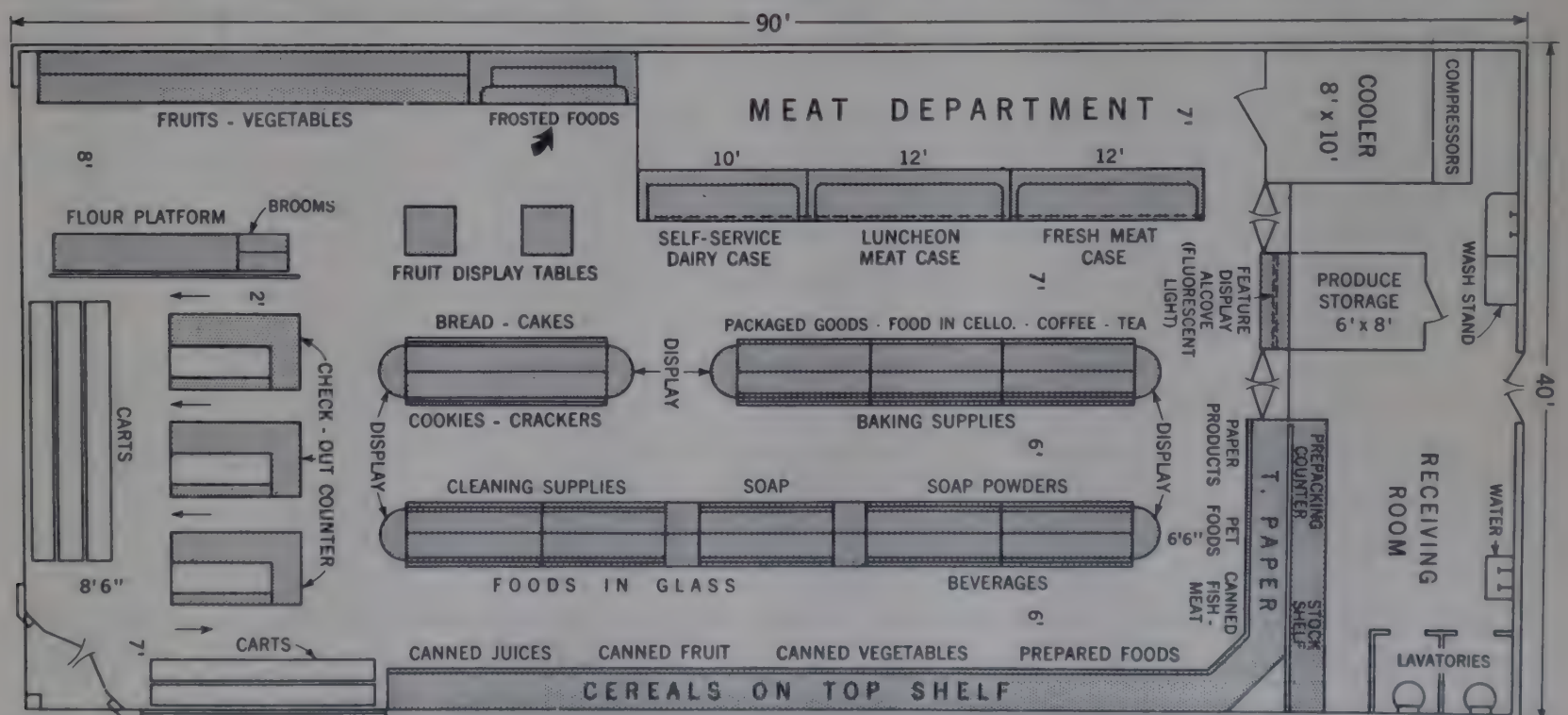


Figure 86.--Frozen-food display cabinets in many retail stores are placed in the fresh fruit and vegetable section. Since most of the frozen foods in the cabinet are likely to be fruits and vegetables this arrangement aids the shopper to select supplies from a wide variety of of both frozen and fresh produce.

is responsible for frozen food, he will probably place the cabinet within the limits of his section. In some instances the man who manages the sales of butter, eggs, and milk, will be responsible for sales of the frozen foods. In this event the cabinet will likely be placed in his department (fig. 87). It very often happens, however, that the location of the frozen-food cabinet is determined by the fact that whenever it is procured, the store manager puts it in whatever space happens to be available, which may be the least desirable location for the display of any commodity.

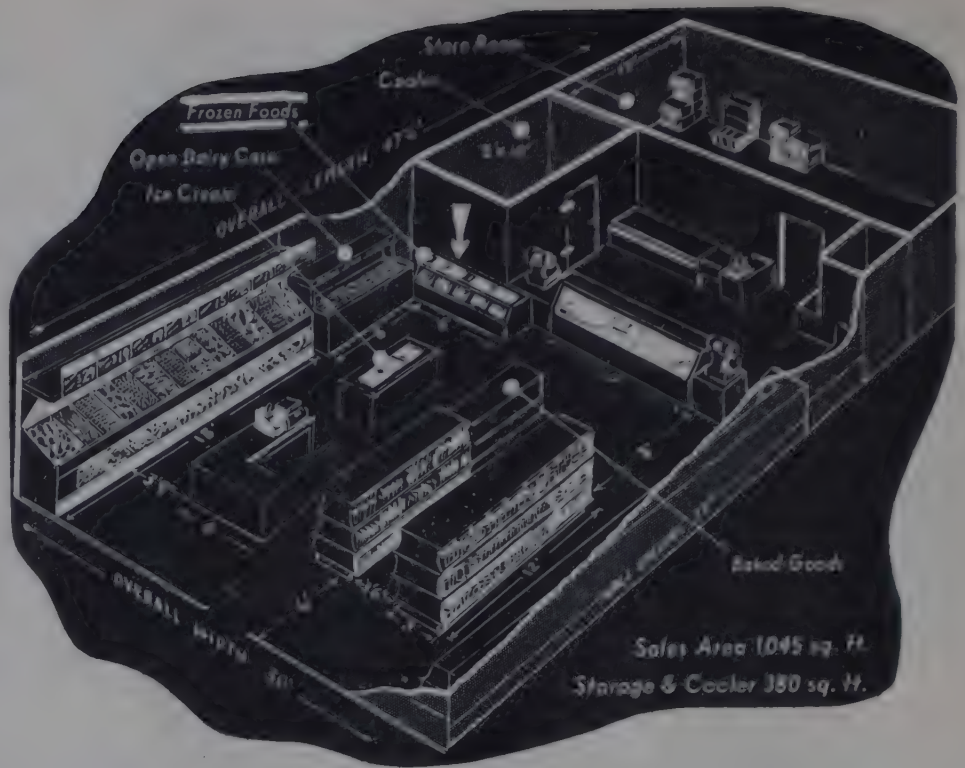


Figure 87.--Frozen-food display cabinets are frequently placed near the dairy cabinets or meat cases in order to group refrigerated facilities in the same area.

Those retailers who have given the location of their frozen-food cabinet serious study have followed one of three practices: (1) They have placed the cabinets in the fresh fruit and vegetable section so that the fresh and frozen products can complement each other--this is because until now frozen foods have been predominantly fruits and vegetables; (2) a few retailers have a practice of breaking the frozen foods down by commodities and displaying each commodity in its corresponding fresh section; that is, they have a cabinet for fruits and vegetables in the fresh produce section, and a cabinet for meats and poultry in the meat section; (3) some retailers place frozen foods in a section by themselves, conveniently located for the store traffic.

It is difficult to say which of these systems is best. The success of a separate frozen-food section depends to a large extent on the proprietor carrying a complete line of frozen foods and upon a thorough job being done on advertising and displaying merchandise. The placing of each frozen item with its fresh counterpart also has favorable aspects. However, several different cabinets at various store locations would likely require greater initial expenditures for equipment as well as a higher operating cost. The location of the cabinet in the fresh-produce section has some merit but the chief drawback to this arrangement is that the frozen items in the cabinet, such as meats, poultry, and specialty products, will be more or less out of place.

Retail-Wholesale Relations

Until recently, with but few exceptions, retailers have not placed much emphasis on merchandising. Since frozen foods have amounted to less than 5 percent of the retailer's food business, they have received only about 5 percent of the retailer's effort in sales promotion. Although some store operators are giving the frozen-food section considerable attention because of the possibilities of long-range benefits, nevertheless most of the burden of sales promotion has rested upon the wholesaler.

The services which a wholesaler renders the retail stores is governed to large extent by his sales system; that is, whether he uses the truck-driver sales method or advance-sales method. If the wholesaler uses the truck-driver sales method, the retailers more or less leave it to the driver salesman to determine what supply the cabinet needs whenever he makes his regular stop. If the retailer is served by several wholesalers, he probably will allocate certain sections of the frozen-food cabinet to each of them. The driver-salesman usually straightens the packages in the cabinet and frequently marks the price on each package. This service is given the retailer because of the keen competition among wholesalers and also in an effort to increase total frozen-food volume. Consequently the frozen-food wholesaler has gone further into the retailing function than is generally true with the wholesaler of other types of food products. However, some wholesalers feel that marking packages and keeping the cabinet orderly are the responsibilities of the retailer. Of course, the retailer is not going to encourage less services by the wholesaler, especially when there is no direct additional charge for them.

In receiving frozen foods by the advance-sales-straight-delivery method the retailer has the task of performing most of the retail functions of stocking and caring for the cabinet. In many cases, however, advance salesmen perform the cabinet "first aid" and mark the prices on packages. There is frequently a tendency for the retailers to neglect doing these little jobs that are essential to good frozen-food merchandising.

By far, most of the retail stores handling frozen foods are supplied by local wholesalers. But, there are a few store organizations that receive their frozen merchandise from other sources. In several instances, retailers were buying frozen foods direct from packing organizations. Although practiced in different ways, this system of direct marketing generally arises from an agreement between the packer, or his agent, and the retail concern. Before retail distributors purchase their frozen foods direct from packers, they must consider the following prerequisites: (1) Ability to buy in large lots; (2) owning or having ready access to relatively inexpensive warehouse space (the creating of such space by a concern might be an expensive venture); (3) owning or having access to special-delivery equipment for servicing the individual stores; and (4) being able and willing to assume the risk of having year-round stocks on hand. The four foregoing prerequisites have been met to a certain extent

by those retailers already participating in direct marketing. Some retailers have developed their own facilities for storage and delivery. Others depend on specialized agencies, such as public warehouses and transportation companies to perform these functions. They also have worked out agreements with packers for a continuous supply and to share the risk involved.

In some cases of direct marketing observed, there was an apparent reduction in the marketing cost that was passed on to the consumer as lower prices. In such a system, however, the main burden of merchandising, cabinet arrangement, etc., rests upon the retailer. In practically all observations, the retailer carried brands, furnished by local wholesalers, in addition to those he obtained directly from the packer. The two reasons given for this was the inability to get a full line of merchandise from the packer and also the salability of the brands carried by the local wholesalers.

Until the pattern of frozen-food distribution becomes more definitely set, the functions of the wholesale and retail distributors are going to overlap at many points. From the standpoint of economies it seems, however, that there are some definite things that each of them can do.

What the wholesale distributor can do:

1. Advise with the retailer on when and how to sell certain products.
2. Help the retailer to avoid overstocking cabinets with slow-moving merchandise.
3. Deliver to the retail store at one time only the quantity of frozen food that the retailer can properly take care of in his cabinet or other storage facilities.
4. Furnish the retailer with consumer educational material and periodically offer the assistance of trained personnel to aid in promoting sales.
5. Deliver, by all means, a solidly frozen product into the freezer storage facility at the retail store.
6. Help the retailer to avoid overinvestment in equipment when he first starts to handle frozen foods.
7. Be careful, when responsible for choosing the label or package, to make a selection that will appeal to the customer and thus add to the merchantability of the product.

What the retail distributor can do:

1. Provide sufficient short-term storage facilities on premises so that the wholesaler will not have to make excessively frequent deliveries.

2. Supervise the cabinet closely to see that it doesn't run out of some items or become overstocked with others.
3. Use progressive merchandising methods, namely, an attractive display, a neat cabinet, accessible products, and strategic location of cabinet in regard to store traffic.
4. Make sure that the price of each is marked on the package or is so displayed that the customer can readily see it.
5. Limit the frozen-food price mark-up to a fair margin.
6. Maintain the quality of the product by expedient handling when receiving it from the wholesaler and by keeping it under zero storage at all times.

What the wholesale and retail distributors can do jointly:

1. Study the buying habits of consumers in each locality and supply the store according to special demands.
2. Sponsor frozen-food educational programs through meetings of consumer groups - church, civic, etc.
3. Study the proper type and size of display and retail storage facilities.
4. Cooperate in local advertising.
5. Work out a system whereby consumers having home freezers can purchase mixed cases of frozen food at a discount.

It stands to reason that as more and more research is done on the marketing of frozen foods, many of the inefficiencies of the system will be exposed and eventually eliminated. However, the very nature of frozen foods will always require that the product be kept frozen at all times and places in the marketing channel. It has been proved that the temperature should be at or near zero and that extreme fluctuations in the temperature of the product should be avoided. During the survey it was found that frozen food was arriving at some retail stores either wholly or partially thawed. Such cases were the result of the unrefrigerated delivery equipment used by the wholesale distributor. It was also found that even when frozen foods were delivered to the retail store at zero degrees, some retailers allowed the product partially or completely to thaw before being purchased. On occasion this maltreatment was caused by the wholesaler's failure to follow through with proper product care or, specifically, his failure to see that the frozen foods were delivered and put directly into a zero storage or zero display facility, or his failure to provide the retailer with the knowledge necessary to handle the product properly. In other situations the retailer was at fault. He failed to have adequate storage facilities to take care of the amount ordered, or he displayed the frozen foods outside of the display cabinet.

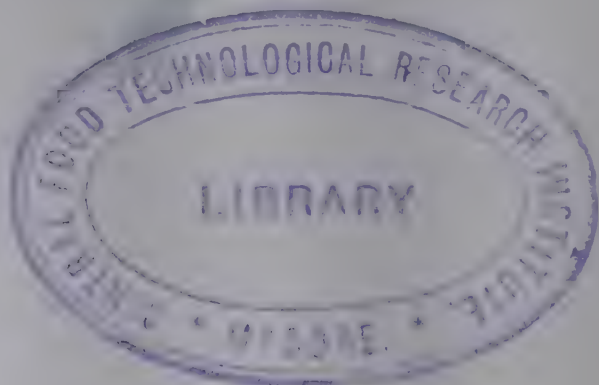
Often these partially thawed foods were refrozen in the retail cabinets after closing hours. Little does it profit the frozen-food industry to exert considerable effort properly to freeze and store its products if they are allowed to thaw between leaving the wholesaler's plant and reaching the consumer.

The Position of Brand Names in the Retail Store

Consumer acceptance of particular brands at the retail store is rather controversial. Everything else being equal, the retailer will stock the brand that has the highest consumer acceptance. But the question arises as to the importance of brand names when compared with other factors of selling. After the facilities and the price have been made conducive to good sales of a product, just how important is its brand? The retailer is interested in knowing just what factors induce a customer to buy, and the importance that he should attach to each. A few retailers have listed the following points as important in selling frozen foods: (1) Popular price; (2) advertising; (3) attractive packages and display cabinets; (4) good quality; (5) instructions on the package for storing and preparing; (6) brand.

Most of the retailers surveyed were hesitant to say that consumers were brand conscious. One retailer summed up the views of many when he said: "Many of my customers do not know one brand from the other. For the most part they judge all frozen foods alike. If a customer buys a bad package then she assumes that it is all bad." Some retailers said that consumers were more brand conscious than they were 2 years ago. Most retailers placed greater emphasis on popular pricing and attractive packages than on all the rest of the factors combined.

The wholesalers when commenting on the importance of brand to the consumer had opinions somewhat different than those given by the retailers. As could be expected, many wholesale distributors who handled popular lines as their main brand, contended that consumers were brand conscious. Some wholesalers said that the brand factor was by far the most important selling point the retailer could have. A few of the leading one-brand wholesalers, however, took the view that brand was insignificant in retail selling. As could be expected, wholesalers who handled a variety of brands agreed with the retailers that the question of brand was of secondary importance.



INSTITUTIONAL AND INDUSTRIAL FACILITIES

Description of the Trades

Although the Nation's numerous public and private eating establishments and the many industrial producers of "manufactured" foods use large amounts of frozen foods each year, their capacity for utilizing them is yet to be fully exploited. By definition, the institutional trade is generally regarded as all eating establishments, such as restaurants, hotel cafes, school lunch rooms, hospital kitchens, and eating places in other such institutions that utilize the frozen product directly for consumption. Industrial concerns are regarded as secondary purveyors of foods and include bakers, preservers, confectioners, ice cream manufacturers, and other firms that use frozen foods as ingredients in their manufactured products. For the purpose of clarification, these two trades also will be referred to as bulk users of frozen foods.

The National Restaurant Association reports that in 1947 the Nation's 525,000 eating establishments served 62,000,000 meals, which is about 14 percent of the total number of meals consumed annually in the United States. ^{16/} On the other hand, the number of industrial concerns that turn out some kind of "manufactured" food product is about 33,000. ^{17/}

The frozen-food requirements for an eating establishment are not always the same as for an industrial concern. The eating places can use large supplies of frozen fruits, vegetables, meats, poultry, and fishery products. The industrial users' requirements are restricted to frozen fruits and eggs, except in cases where a bakery uses such vegetables as rhubarb and pumpkin for pies. Frozen fruits are used largely by preservers, bakeries, and ice cream manufacturers; whereas, frozen eggs are used in large quantities by manufacturers of such products as mayonnaise and pastries. Generally, the frozen foods that go to the institutional trades are in smaller containers than products going to industrial users.

Just how many of these numerous institutional and industrial concerns use frozen foods has not been determined. Nor has it been determined how much frozen food is used by different types of establishments. During the survey it was found that in certain areas or towns, eating establishments were using large quantities of frozen foods, whereas in other localities very little was being used. Generally, the so-called high-class eating places are the foremost users of frozen foods, but this is not a

^{16/} The 525,000 eating establishments include dining rooms and lunch counters in schools and other institutions. The 14 percent is derived by allowing 3 meals a day for each adult and child (excluding infants).

^{17/} The U. S. Census for 1939 reports 171 establishments manufacturing preserves and 2,734 concerns engaged in producing ice cream. The American Bakers Association reports 30,000 bona fide bakeries in operation in 1947.

steadfast rule by any means. Any restaurant that is willing to pay a small premium for its food and for efficient handling in preparing meals is a good potential customer for frozen foods.

As in the retail trade, the expansion of frozen foods in the industrial and institutional trades depends upon: (1) Increased consumption in the outlets that are now at least part-time users of frozen foods, and (2) expansion into those concerns that are not yet users of the frozen products. Observations made during the survey indicate that considerably more effort is being made to expand business in places where frozen foods have already gained a foothold, than in trying to win new users. Wholesale distributors indicate that most potential users resist frozen foods on the grounds that prices are too high.

The Role of the Wholesaler in Supplying the Bulk Trades

According to the survey, 85 percent of all frozen-food wholesalers cater to the institutional or industrial trades. However, there is quite a variation as to the extent to which they are engaged in business with these bulk users of frozen foods. Two-thirds of those that serve both the retail and bulk trades report that the latter amounted to less than 50 percent of their total frozen-food business. Although most of the frozen food purchased by bulk users is bought from local wholesalers, the industrial trade, especially preservers, acquire large amounts of their supplies directly from the packer or through brokerage companies. Practically all the frozen foods that are packed in barrels, as well as in a small percentage of the other large institutional containers, are marketed in this way. As discussed in a previous chapter, a few of the wholesale distributors that serve the industrial trade handle rather small quantities of frozen foods. These distributors were found to be handling frozen products merely as a supplement to their other main-line commodities. Many of them who sold only small amounts of frozen foods were primarily dealers in other bakery supplies.

As was mentioned in the chapter on delivery facilities, it is the exception rather than the rule for frozen foods to be delivered in refrigerated trucks from the wholesaler's plant to the institutional and industrial trade. This practice seems justifiable when frozen foods arrive at their destination just prior to the time when they are needed for use in a thawed condition. Numerous proprietors of eating establishments stated that they actually prefer to have the foods partially or wholly thawed upon arrival, because of the time saved in meal preparation.

It appeared that of the wholesalers surveyed who were serving the bulk trade, over half are doing a "good" job. Those who are not are defaulting primarily in the following ways: (1) Failure properly to identify the quality of their merchandise; (2) failure to provide the user with adequate information as to how frozen foods should be handled for best results; (3) failure to inform the user of the true advantages that can be realized from using frozen foods.

Of the three complaints made the first one seemed to be the most prevalent. One restaurant operator summed up the attitude of many bulk users when he said that the biggest contribution to institutional frozen-food merchandising that can be made by the wholesaler is for him to represent his product properly to the trade. In other words, he advocated that when a distributor has a low-quality product that has to be moved, the product should be represented to the trade as low-quality and channeled to a segment of the industry where it can be used to best advantage.

Although wholesalers had complaints against bulk users, they listed the following grievances as obstacles that could be overcome: (1) The resistance of chefs and other potential users, because of "custom" in preparing foods; (2) the higher unit price than the canned or the fresh foods; and (3) the improper handling of frozen foods between the time they are delivered and the time they are utilized.

Although frozen foods may have some advantages over other foods, bulk users have to be shown exactly wherein these advantages lie. Chefs, bakers, and other users are not going to change from a long-tested and satisfactorily proved line of canned and fresh unfrozen foods to the use of the frozen merchandise until convinced of the advantages to be gained. Herein lies another educational job for the wholesale distributor. It is going to be "up to him" to familiarize the bulk user with the comparative advantages of frozen foods.

It is generally conceded by members of the trade that the unit price for frozen foods is slightly higher than for a comparable volume of the general line of canned and fresh nonfrozen products. In some instances this higher price can be justified by the higher quality of the frozen product. With proper use, however, the savings realized from reduced labor, time, and wastage in meal or in end-product preparation, may more than compensate for the slightly higher price. The factor of convenience in handling is not easily measured, yet this factor is worth something to the user.

The improper handling of bulk frozen foods at the user's premises has often been caused by the lack of properly refrigerated equipment. Many institutional and industrial concerns do not use more frozen merchandise because they have no zero storage facilities to hold the products from one day to the next. In some instances bulk users who attempt to hold frozen goods for several days in cooler storage experience unfavorable results when serving or otherwise using the product.

During the survey, numerous wholesalers were asked to name the advantages of frozen foods to eating establishments. Three advantages listed by all wholesalers who were thus queried are: (1) Ease in preparation; (2) labor saving; (3) a general superior flavor and color. It was surprising to learn that one of the inherent advantages of frozen foods, that is, their flexibility in menu planning when readily available in large quantities, was seldom listed by wholesalers as a factor in sales promotion to institutional users. However, a closer inquiry

revealed the reasons why this factor was not emphasized. Only a small percentage of the eating establishments that were using frozen foods had zero storage facilities. When there are no facilities on the premises for short-term storage the eating establishment loses the effect of menu flexibility that could be realized when frozen foods are held in large quantities. Obviously, most eating establishments have some kind of cooler storage facilities but this storage is not suitable for holding frozen foods. Because eating places usually do not have freezer-storage facilities the servicing of them by wholesalers is done more or less through daily deliveries. But, even with daily delivery it might be a disadvantage in some cases for the chef to use frozen foods regularly because of the necessity for expeditious handling once the product has thawed.

Although some wholesalers have increased their sales to bulk users through brand advertising, this method appears to be of secondary importance. Bulk users have commented that first of all they prefer a quality product that meets their particular needs; next they want a "well-priced" product from a reliable dealer--one who will make proper adjustments when such are necessary. For the most part, brand is important only in identifying the wholesaler with the quality of product he sells and the type of service he renders. In the survey it was found that bulk users of frozen foods in one locality would speak favorably of a particular brand and in another town similar users would look with disfavor upon that same brand. For the most part differences were due to variations in services rendered by wholesalers.

On-Premise Storage Units

The bulk user of frozen foods can aid in distribution by providing short-term zero storage equipment on his premises. However, this addition of equipment cannot be expected of him unless he can be shown that such a facility will bring him profit. Although some wholesalers have considered the idea of providing eating establishments with storage boxes on a rental basis, this plan does not seem to have much merit, mainly because of the large outlay of capital that would be involved. Also, there would be the disadvantage of upkeep and maintenance. Then, too, there would be a discouraging aspect from the restaurant proprietor's viewpoint because taking on such a facility would tend to bind him to trade with one distributor.

Before many restaurants and other users of bulk frozen foods acquire zero storage facilities, it would be advantageous to make a careful analysis as to what type of facilities would best suit the needs of various establishments. Generally, users should acquire the size of facility that would be used to fullest capacity. However, this would encourage proprietors to buy small facilities, and in so doing their frozen-food business might quickly outgrow their cabinet capacity. It has been the experience of many firms to underestimate their freezer needs.

Different types.--The frozen-food storage facilities used by institutional concerns are generally of three types: (1) Chest; (2) vertical;

(3) walk-in. Most industrial storage facilities are of the walk-in type. Unlike the retail store cabinets, these facilities are used entirely for storage purposes with no regard for display features. And, somewhat like the home cabinets, they are of the closed type; that is, the lids or doors are closed at all times except when merchandise is actually inserted or removed from the cabinet.

As discussed before, the three types of storage units have advantages that are peculiar to each. In the chest type cold air is heavier than warm air and thus does not escape excessively every time the door is opened. The main advantage of the vertical type is that it occupies vertical space, and consequently does not take up as much floor space for the same amount of storage capacity. Most large freezers are of the walk-in type, because of the ease in reaching the contents. A walk-in freezer is convenient to use and usually permits more insulation, thus reducing the cost of operation. Also, walk-in freezers can be easily combined with walk-in coolers. Of course, the main disadvantage of the walk-in type is that it is often built right into the building and is usually not removable. However, walk-in freezers of the commercial prefabricated type are available.

At institutional concerns.--It has been the policy of most eating establishments in the country to purchase most of their perishables on a day-to-day basis. The common system is to receive in the early morning of each day the needed supplies of perishable commodities, especially meats, poultry, fruits, and vegetables. Week-end supplies are usually bought on Fridays. This system has resulted in a minimum need for refrigerated storage facilities on premises. This is the situation that frozen foods have encountered, and it is likely to continue until such a time that institutional and public eating places can be shown advantages in installing zero-storage facilities so that frozen foods can be purchased in large quantities. If these bulk users can make purchases less frequently by having zero storage on their premises, then it appears that economies can be realized in the distribution phase, especially if wholesalers realize corresponding economies in the use of delivery equipment.

When more frozen-food storage space becomes available in institutional and public eating places, it probably will come as a result of the proprietors of these places making outright purchases of facilities. However, it should be a function of the wholesale distributor to show the user exactly how his particular operation can be benefited by acquiring a storage unit and using more frozen foods. To gather facts that are necessary for correct advice will require unbiased research directed toward showing the conditions that must exist before an eating concern can benefit by obtaining a frozen-food cabinet and consequently by using more frozen foods.

At industrial concerns.--Since the frozen-food stock requirements of industrial concerns are somewhat different than those for eating establishments, there are a few differences in basic needs for storage facilities. In the first place, industrial users are not so much concerned with the

advantage of day-to-day flexibility but rather are more concerned with getting an adequate supply (usually for the season) of the exact type of product that is required. For example, in the making of preserves, a manufacturer likes to have a frozen fruit that is, month after month, consistent as to color, texture, sugar content, and quality. The industrial concern when purchasing direct from local wholesalers is likely to find it more advantageous to have requirements delivered as needed.

Also, the industrial user demands only a small number of different items as compared with a large number demanded by eating establishments. For example, an ice cream manufacturer will use only 5 or 6 of the main fruits year after year, whereas, a restaurant will use many different fruits and vegetables. Thus, when a manufacturer uses a small number of items in large quantities he can purchase in straight carload lots direct from packers or brokers. In such cases, the purchasing company might use the warehouse for all of its storage or provide space on its premises for several carloads. Most of the industrial concerns visited depended on the warehouse for both long-term and short-term storage when they bought in carload lots. The ice cream manufacturers who because of the nature of their business stored fruit on the premises of the plant, were an exception to this rule. However, in such cases, the long-term storage was done at the local refrigerated warehouse and only small amounts were held on the plant premises. Some bakers, preservers, and other industrial users have short-term storage facilities on their premises (fig. 88). Others however, rely on the local wholesaler for deliveries as needed or on the warehouse to store their products.

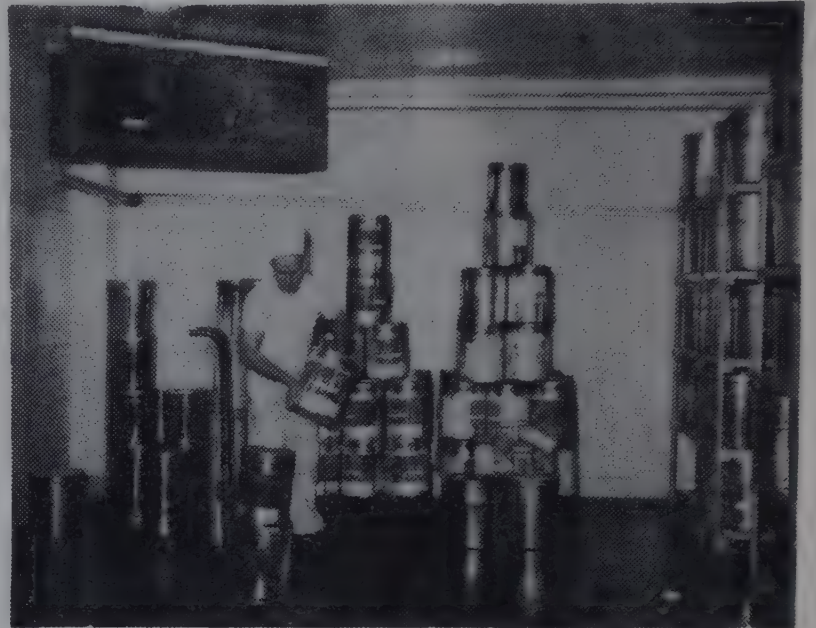


Figure 88.--Many industrial users of frozen foods have zero storage facilities at their plants. From this walk-in freezer, a baker selects several cans of frozen foods for use in baking pies.

It is difficult to say what type of industrial operations should have on-premise storage facilities and what type of operations would benefit more by allowing wholesale distributors and warehousemen to perform the short-term storage function. A more detailed analysis than has been made of the problems involved is necessary to determine what the important factors are and how much weight each factor should have.

LOCKER PLANTS

History of Development

The frozen-food locker plant is unique in the frozen-food industry in that it frequently combines, in one facility and at one location, all the operations from processing to retailing.

Although frozen-food locker plants are still relatively new, it is reported that they probably had their origin as early as 1903, when a cold-storage plant in California permitted its patrons and local farmers to store produce in boxes for a nominal fee. Similar services gradually became available throughout the country under various circumstances where refrigerated storage facilities were in existence. For example, in the Green Bay region of Wisconsin, which is one of the oldest locker-plant sections of the country, the manufacturers of cheese and other dairy products provided space in their refrigerated storage rooms for small lots of meat and produce as an accommodation to their customers. In other parts of the country, particularly in the North Atlantic and Western States, ice cream plants and refrigerated storage houses adjusted their facilities to provide frozen-food lockers when desired by their patrons. In the small rural communities in which locker plants are predominantly located, the plants usually were developed in connection with some other type of business, such as a grocery store, meat market, or even a general store, at some country crossroad.

At first packages of food were just stacked in storage rooms which were not provided with any special facilities. Later plant operators provided wooded racks in the refrigerated rooms which were used to handle this new type of business, thus enabling a larger quantity of stocks to be stored in a given amount of space and at the same time retaining the identity of each lot and making it readily accessible. Once this new service had been started the demand for it increased continuously. Therefore, many companies found it worth while to construct specialized plants with low-temperature storage rooms equipped with individual lockers for use by their patrons on a rental basis. Also, freezing and processing facilities were included.

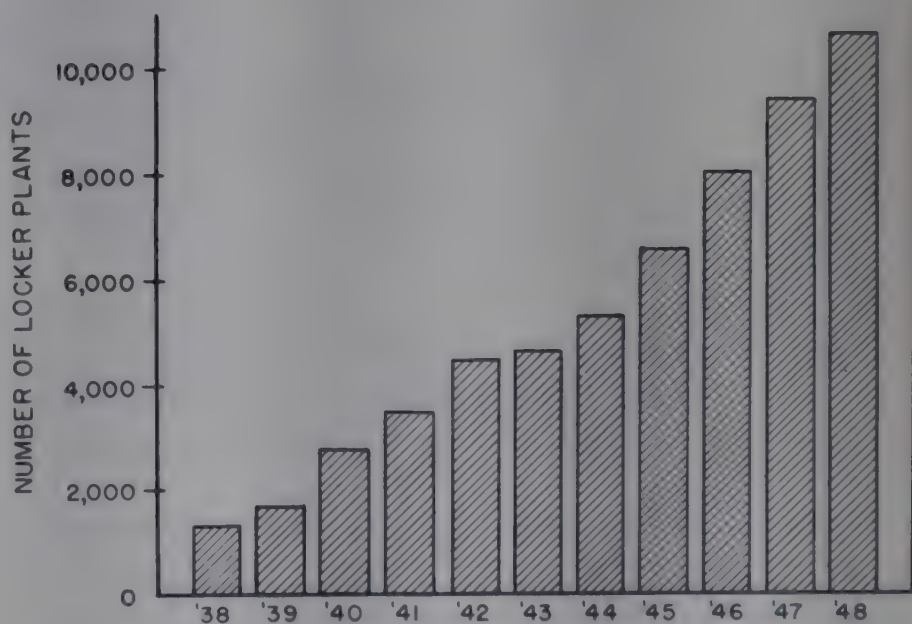


Figure 89.--Number of frozen-food locker plants in operation, annually, 1938-48.

Source: Extension Service, U.S. Dept. Agr., Frozen Food Locker Plants in the United States, Eleventh Annual Count, July 1948.

The development of the locker rental system during the first 30 years was limited owing to inadequate refrigerated facilities and lack of general knowledge of the quick-freezing principle. Since 1935, however, the number of cold-storage locker plants has increased rapidly. Figure 89 shows the yearly totals and the increase in the number of locker plants during the past 11 years. The number of plants increased each year until a total of 2,870 was reached in 1940. During the war years, many plants were constructed even in the face of scarcity of essential materials and equipment which were subject to the war priority regulations. Since the war the number of locker plants has increased at an average rate of more than 1,300 per year, and it is now estimated that there is a total of 10,617 in existence and that they contain approximately 5,306,000 locker boxes. ^{18/} It has been estimated that 1-3/4 billion pounds of food are now stored in the locker plants of the country during a year. This amount of food supplies at least part of the needs of 4 million families or about 22 million people.

^{18/} U. S. Dept. Agr., Extension Service, Frozen Food Locker Plants in the United States, Eleventh Annual Count, July 1948.

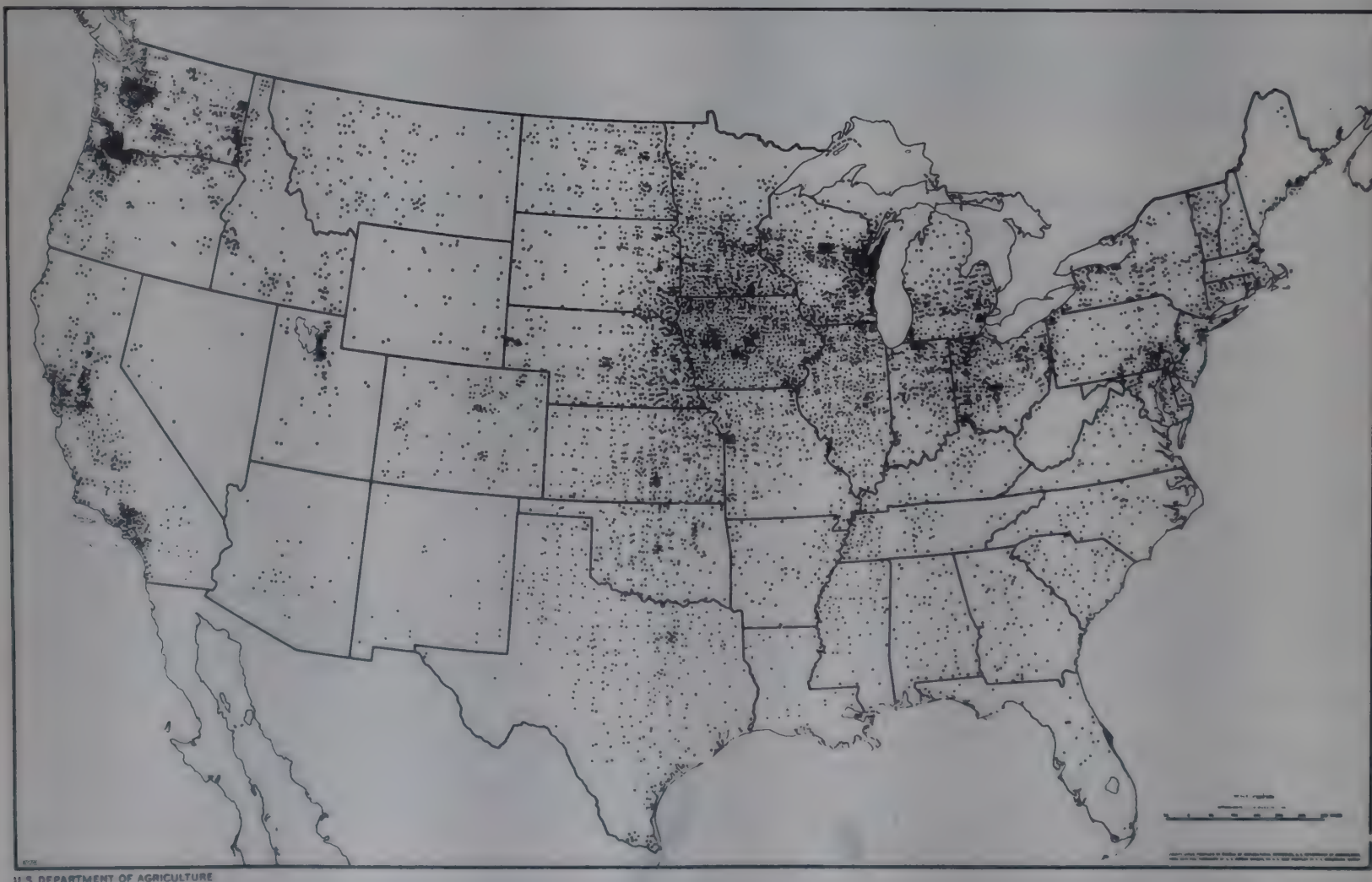


Figure 90.--A distribution of frozen-food locker plants in the United States 1948. (Location of plants within the States are approximate.)

Source: Based on U.S. Dept. Agr. Extension Service figures and unpublished data, Production and Marketing Administration, Marketing Facilities Branch.

The Geographical Distribution of Locker Plants

The geographical distribution of frozen-food locker plants in the United States as of July 1948, is shown in figure 90. It will be noted that the greatest concentration of plants is found in the Midwestern and West Coast States. Iowa leads with 841 plants, followed by Washington, Minnesota, Wisconsin, and Illinois. Although a substantial increase took place during the year 1947 in most of the States, the greatest gains were made in Missouri, Iowa, Washington, Colorado, and Nebraska.

Since beef, pork, and poultry represent more than three-fourths of all foods processed in the average locker plant, it is not surprising that these plants are found in larger numbers in the thickly populated farm areas of the Midwestern States, which are important in the production of livestock and poultry. During the past few years locker plants have been also expanded quite rapidly throughout the Southern and Eastern States.

Predominance of Plants in Rural Communities

Figure 91 shows that 74 percent of the frozen-food locker plants in the United States are located in towns of less than 5,000 population, which serve as trading centers in farming areas. Perhaps the principal reason for this is that the locker plant offered a new method of preserving and storing farm products grown for home use. Heretofore, the killing and processing of meats by farm families was practical only during the colder seasons and in most sections of the country home-grown fresh fruits and vegetables were available only in the summer months. The quick-freezing process, however, made it possible to slaughter animals the year-round and to freeze fruits and vegetables during the production season for use later, thus enabling families to have fresh meats and produce throughout the year. Furthermore, the frozen-food locker plant enables the farmer to kill his livestock and poultry as soon as they are ready, and thus avoid feeding them over a longer period than is necessary.

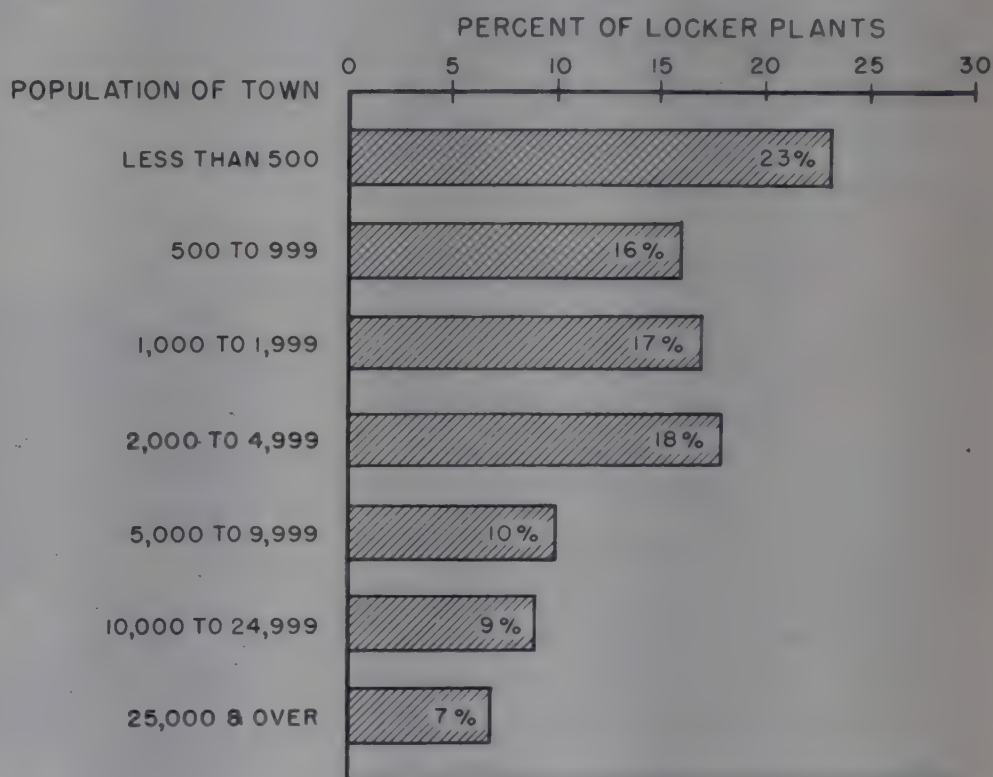


Figure 91.--Percentage of frozen-food locker plants operating in towns of indicated population, January 1, 1946.

Source: Farm Credit Administration, U.S. Dept. Agr., Miscellaneous Report 105, February 1947. Based on a survey of 2,882 locker plants.

Another reason for locker plants existing predominantly in rural communities is that small towns usually have very limited, if any, processing or bulk storage facilities, such as a local meat-packing plant or a public refrigerated warehouse. The locker plant has been able to serve this need.

It can be observed in figure 90 how thoroughly the 841 locker plants are distributed over the entire State of Iowa. No community of any significant size is without this service. This is also true of Wisconsin and some of the other States in which the industry is highly developed.

In some communities patrons live as far as 50 miles from the locker plant. However, as a rule, most regular patrons live within a radius of 5 or 10 miles, depending on the availability of locker space and the density of population. Figure 92 shows as of April 1, 1945, the areas in Ohio that are within 5 miles of the 230 frozen-food locker plants. The small area served by the average plant emphasizes the extent to which locker facilities have become an integral part of many rural communities. However, the illustration also shows that many rural areas are still not served with a nearby locker plant.

Figure 93 shows the location of locker plants in Mississippi, which is typical of plant distribution in most Southeastern and Mountain States. Even though this State is predominantly agricultural and has a relatively dense rural population, there are no plants in 19 counties and only 1 or 2 in most of the other counties.

Plants in Urban Areas

Although many think of the frozen-food locker plant as being exclusively a rural institution and although at one time this might have been true, it is not the case today. In fact, many small-town locker plants that are less than 10 to 15 miles from larger cities report an increasing number of urban patrons. For instance, it was estimated by a locker plant operator with a plant

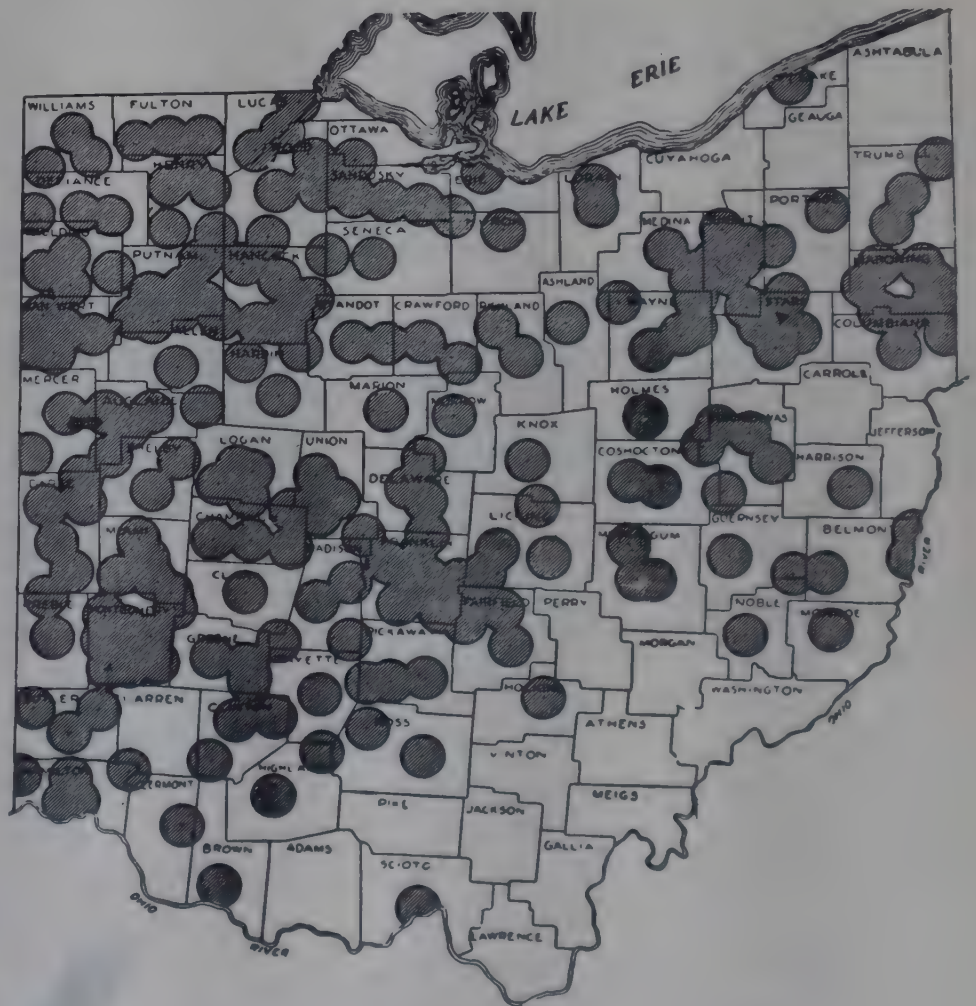


Figure 92.--Areas within 5 miles of cold storage locker plants in Ohio, April 1, 1945.

Source: Cold Storage Locker Plants in Ohio, Bulletin 668, Ohio Agricultural Experiment Station.

in a small town near Indianapolis, Ind., that 50 to 90 percent of his patrons were from the larger city. As of January 1, 1946, 16 percent of the locker plants were located in cities of 10,000 population or more, and over one-third of their customers were nonfarm patrons. In cities with more than 25,000 people, there were 51 percent non-farm patrons. 19/

Locker plants have become more numerous in cities in the far West than they have in cities in other sections of the country. This can be seen in figure 90, which shows a concentration of plants in and around Spokane, Seattle, Portland, San Francisco, Los Angeles, and Salt Lake City. Seattle alone has 50 plants, which are quite evenly distributed throughout the entire city. There are a few midwestern cities, however, in which locker plants are found near the heart of town. Indianapolis, Ind., is a good example of this concentration.

Just why frozen-food locker plants are more common in cities in some sections of the country than in others is not clearly understood. One factor which may cause this is the nearness of the city to prominent producing areas. For example, in Phoenix, Ariz., there are 7 locker plants located within a 12-mile radius of the center of town. Phoenix is located in an area where cattle, vegetables, and fruits are produced in abundance. On the other hand, in cities such as Boston, Pittsburgh, and New York, which are not bordered by concentrated producing areas there are relatively few locker plants.



Figure 93.--Locker plants in Mississippi by counties - 1949.

Source: Ext. Service, Miss.
State College, State College,
Miss.

19/ Farm Credit Administration, U. S. Dept. Agr., Frozen Food Locker Plants, Location, Capacity, Rates, and Use, Miscellaneous Report No. 105, February, 1947, pp. 17 and 19.

Processing Services

To maintain their function of renting lockers most plants have added some type of processing service. Since locker plant processing facilities are designed primarily for handling meat, most of the processing services discussed in the following paragraphs pertain directly to this product.

Slaughtering or receiving.--Animals to be slaughtered may be picked up on the farm by locker-plant trucks or brought to the plant by the farmer or other owner. Some plants have holding pens or barns in which the animals may be kept until killed. Excited or overheated animals are not slaughtered until they have become more nearly normal. A thorough bleeding is necessary and bruises are trimmed to insure proper keeping of the meat. Separate rooms are provided for killing, picking, and eviscerating poultry.

When a carcass is brought to the locker plant, it is taken to the receiving platform where it is removed from the truck by an electric- or hand-operated hoist and hung on an overhead rail. The carcass is then moved along the rail to the track scales where it is tagged according to ownership, weight, and date. A separate sheet, which consists of a list of cutting instructions, is filled out by the owner and accompanies the carcass to the cooler.

Chilling.--After an animal has been slaughtered or a carcass received at the plant, it is placed immediately in the chill room. Spoilage and off flavors will result if the temperature of the carcass is not quickly reduced to 34° F. To insure even chilling carcasses are hung so that they do not touch. Freshly slaughtered meat is allowed to hang in this room until the body heat has been removed; usually 12 to 18 hours is sufficient. The fat of pork will become rancid much faster than that of beef, therefore it is never held in the chill room more than 2 or 3 days. Pork, veal, and poultry go directly from the chill room to be cut and packaged, while beef and lamb go to the aging room.

Aging.--The aging room is usually located between the chill room and cutting room. It is equipped with overhead rails and is held at a temperature of about 34° F.

Beef and lamb are moved into this room to be aged from 5 to 9 days, depending on the thickness of fat. Grades of Choice and Good require from 7 to 9 days. Meat of grades lower than Good require up to 5 days, depending on its condition and the facilities available. During this aging process, which will continue after freezing, the connective tissues of the lean meat become more tender. Meat that lacks the necessary protective covering of fat, firmness of flesh, and desired resistance to bacterial action is readily subject to deterioration, undesirable odor, heavy trimming, and even total spoilage.

Cutting.--The cutting is done on a straight assembly-line basis with the meat moving from the block to the power saw, to the trimming table,

to the wrapping bench, and finally to the freezing room. The carcass is cut into wholesale cuts, then into steaks and chops of the thickness directed by the instruction sheet. In most plants the owner of the meat is invited to be present in the cutting room to direct the cutting according to his preferences. The meat that is to be cured is tagged and sent to the curing workroom. Some meat is set aside for use in making sausage or is ground for use in hamburger or meat loaf.

The number of meat cutters employed by the plant depends upon the volume of business of the individual plant. One man will usually cut about 2,500 pounds of meat a day. On an average there are two men used for cutting meat in a medium-sized plant.

Packaging.--Proper packaging materials are of primary importance in maintaining the high quality of frozen foods. Many complaints about frozen foods today can be traced directly to the materials in which the food is wrapped. Oxidation, dehydration, and flavor reversions take place in foods which are poorly packaged, the result being that the product is unfit for human consumption. Packaging material should be moisture-vapor-proof, grease-proof, odorless, nontoxic, flexible enough to be fitted closely to the product, easily marked for identification purposes, and economical in price.

Part of the success in packaging is dependent on wrapping techniques. Many experiments have proved that the drug-store method of wrapping is superior to the butcher-wrap. Figure 94 shows each of these methods. After wrapping the packages are stamped with the date, the number of the locker, and the description of the product.

Freezing and storing.--
The size of the freezer room varies with the volume of

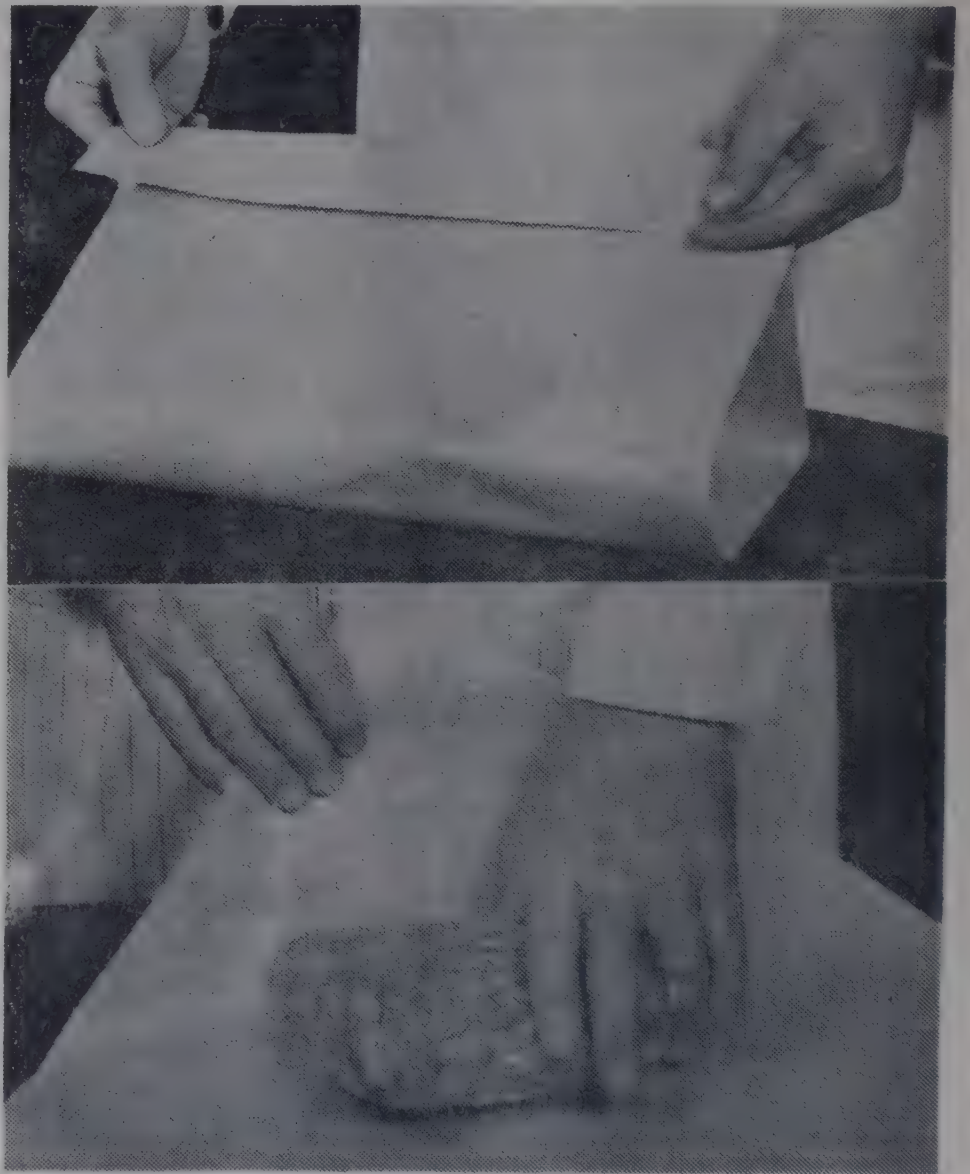


Figure 94.--There are two generally accepted methods of wrapping meat before freezing. The drug-store wrap (top), where the meat is placed in the center of the paper, usually permits a tighter airlock. In the butcher wrap (bottom) the meat is placed in the corner of the paper.

business of the individual plant. Small plants, branch plants in particular, may have only freezer cabinets measuring about $2\frac{1}{2}$ feet deep, 5 feet high, and 5 feet wide, with 4 or 5 plates on which to place the packages. Larger plants may freeze packages of food by placing them on pipe coils (fig. 95) or in a blast freezer. In the latter case, carts loaded with trays of packages are pushed into the freezer room. It is believed by many people that for best results the freezer cabinet or room should have a capacity, both in size and refrigerating equipment, for freezing 2 pounds of food per locker per day. The temperature of the freezer room is usually held at 0° F., although many plants freeze at temperatures much lower than this.

After the meat has been cut, wrapped, and frozen, it is ready to be put in the locker room, which is commonly held at 0° F., and is refrigerated by overhead coils or plates or by the air-blast system. When coils and plates are used, they are located over the aisles rather than over the lockers to facilitate cleaning the locker room after defrosting.

Lockers are of various sizes and types. Although steel lockers, which are sturdy, attractive and easily installed, have come to be accepted as standard throughout the industry, some of the early locker plants still retain their wooden boxes. Popular sizes range from 5.6 to 7.5 cubic feet, with the average about 6 cubic feet. Lockers of both the drawer and door type are available. Usually the lower two or three lockers in a tier are of the drawer type and are somewhat larger than the three or four door-type lockers above them. The charge for renting a locker is based on the convenience and size of the locker. Monthly rental is discouraged by keeping these fees high in comparison with the annual rate.

Curing and smoking.--A survey made by the Locker Management magazine, reveals that 61 percent of the locker plants in the country have facilities for curing and smoking and that another 12 percent are planning to add these facilities. The artery cure seems to be the most common method in locker plants as in the packing industry. This system consists of



Figure 95.--In some locker plants freezing is done by placing packages of food in baskets and placing the baskets directly on refrigeration coils. As in air-blast freezers, the temperatures in these coil rooms are held at below 0° F.

pumping a brine solution into the artery of the ham and rubbing the sides with a mixture of salt, sugar, and salt-peter. The curing room is provided with wooden bins for the storage of customers' meat while it is being cured. Cleanliness and sanitation are two important factors in the storage of cured meats, as is the maintaining of the proper temperature of 36° to 38° F.

Smoking requires the use of heat and smoke. Heat removes the moisture and tenderizes the meat, while smoking gives the meat a desirable out-size color and a pleasing flavor.

Rendering of lard.--The rendering of lard from pork fat is usually done in an open kettle with a steam jacket. This is a relatively simple process although much care should be taken to prevent fires in the plant.

Sausage making.--It is estimated that more than half of the locker plants in the country make pork sausage. This process consists of grinding about 60 percent lean meat with 40 percent fat and adding salt, pepper, and sage. The seasoning may be bought "ready mixed," although some operators prefer to mix their own. Some experiments have shown that commercial salt (or its impurities) increases the speed of rancidity, while pepper and sage seem to retard it. If the sausage is to be stored for a long time, seasoning should not be added. Many plants make types of sausages other than the more common one described above.

Processing of fruits and vegetables.--The majority of plants have no special facilities for processing fruits and vegetables. In most cases the products are prepared in the home and brought to the plant for freezing. Some plants have kitchens where the housewife does the work and qualified persons advise them as to the procedure and the fitness of the product for freezing. A few plant operators prefer to have all the work done by plant employees. Most vegetables require blanching (scalding) then cooling quickly in ice or cold water before packaging. Fruits are prepared for freezing in much the same manner as when the fresh product is prepared in the home for table use.

Inspection.--Although much has been said about the advantages of freezing, the locker plant operator knows that it does not improve the quality of the product. With this thought in mind, he demands that all foods be inspected by a representative of the plant for quality and to be sure that the contents of all packages are thoroughly frozen when put into the locker.

Charges for processing.--When the animals are picked up on the farm by locker-plant trucks, 5 to 10 cents per mile is charged for the service. Some operators who do not have slaughter plants send the locker butcher to the farm and charge a flat rate based upon the live weight. A survey of the charges for processing made by the Locker Management magazine, indicates that the rate for slaughtering per animal is \$2 to \$3 for hogs up to 300 pounds, \$3 to \$4 for hogs over 300 pounds, \$2.50 to \$3 per animal for cattle weighing less than 800 pounds, \$3.50 to \$5 for the heavier ones, and \$1.50 to \$3 for lamb and veal.

Cutting and wrapping charges for meat vary from 3 to 8 cents per pound, the average being 4 cents. Many plants have several kinds of wrapping materials and charge according to the kind used. The fee for grinding and rendering lard is based on the raw fat weight and averages 4 cents per pound. Other processing charges are shown in table 15.

Table 15.--Charges for various locker-plant services

Service	Range		Average
	<u>Dollars</u>		<u>Dollars</u>
Rent (varies with size and convenience)			
Annual	12.00 to	20.00	16.00
Monthly	1.00 to	2.00	1.50
Extra lockers (per month)	1.00 to	1.50	1.35
Slaughtering per head (varies with weight)			
Hogs (to 300 lbs.)	2.00 to	3.00	2.50
Beef (to 800 lbs.)	2.50 to	4.00	3.25
Veal	1.50 to	3.00	2.25
Sheep	1.50 to	3.00	2.25
Mileage	.05 to	.10	.075
Chill, cut, wrap, freeze (per lb.)	.03 to	.08	.04
Brokerage	.02 to	.04	.03
Grinding (per 100 lbs.)	1.25 to	2.00	1.50
Curing (per 100 lbs.)	3.00 to	5.00	4.00
Smoking (per 100 lbs.)	2.00 to	3.00	2.50
Sausage making (per lb.)	.02 to	.05	.035
Rendering lard (per lb.)	.03 to	.05	.04
Drawing, dressing, and wrapping chickens (per head)	.15 to	.25	.20
Dressing, drawing, and wrapping ducks (per head)	.25 to	.50	.35
Dressing, drawing, and wrapping geese (per head)	.25 to	.50	.40
Dressing, drawing, and wrapping turkeys (per head)	.25 to	.50	.40
Freezing fruits and vegetables (per lb.)	.02 to	.07	.04

Source: A Survey of Locker Service Charges, Locker Management, vol. 2, no. 4, April 1948, p. 28, published monthly by Locker Management, Inc., St. Louis, Mo.

Other Operations of the Plant

Locker plants have made important progress in the field of frozen-food distribution by expanding their normal sources of revenue from processing and locker-rental services to include furnishing bulk storage facilities, selling meats and commercial frozen foods in retail and wholesale quantities, selling home freezer cabinets, in some cases delivering frozen foods to the home, and operating branch plants for the convenience of customers. These operations are designed to help patrons get complete supplies of frozen foods more economically and conveniently.

Bulk storage.--Some locker plants have facilities for bulk storage. This service is usually offered to restaurants or hotels who need cooler or freezer space for storing small quantities of food. It is one of the ways in which the plant is able to raise additional revenue.

Sale of home freezers.--Many locker plants in the United States are selling home freezers. There are two general reasons why they sell this equipment. One is for the purpose of adding another source of revenue and the other is to increase the number of patrons dependent upon the locker plant for services and supplies. The latter point is considered controversial among some members of the locker-plant and home-freezer industries. Some plant operators who sell home freezers, attempt to maintain contact with the purchasers and furnish them with food supplies. In this respect the locker plant is in a good position to furnish a complete line of frozen foods to home-freezer owners and to aid them in using these facilities to better advantage.

Sale of meat.--If a locker plant is located in an urban area, the plant operator will buy meat from packing houses and sell it to patrons at wholesale. It is estimated that about three-fourths of all plants do this. Usually the meat is sold in whole or half carcass form, although some plant operators sell in smaller cuts, such as quarters. The housewife can buy the wholesale cut of the grade of meat she prefers, have it processed, wrapped, frozen, and placed in her locker. In urban areas, home-freezer owners often purchase their meat supplies in quantity from a locker plant. The consumer usually pays a flat price for the meat which covers processing and freezing.

Sale of commercial frozen foods.--In addition to other activities, an increasing number of locker plants are adding the distribution of commercial frozen foods to their operations, in an effort to become established as complete frozen-food agencies for the areas which they serve. It is estimated that about three-fourths of the locker plants in the country are selling retail packs of frozen foods at least to a limited extent. Although in some plants commercial frozen foods are retailed from display cabinets, just as is done in retail stores, other plants encourage quantity buying by offering price discounts. Several plants visited during the survey offer fruits and vegetables to consumers in large economy packages of the 2½-, 5-, and 10-pound institutional sizes. Of course, quantity purchases for the most part are made only by people who either rent a locker or have a home freezer.

In addition to selling commercial frozen foods to consumers, some locker plants operate a wholesale distribution and supply products to restaurants, bakers, and retail stores.

Home delivery.--The locker plants that have set up a home-delivery service to their patrons, have met with varying degrees of success. One operator expressed complete satisfaction with his particular arrangement. He sends out price lists, solicits orders by telephone and delivers the frozen foods in that sequence to his customers each week. If this operation proves economically sound to the locker-plant operator, it should contribute much toward keeping the home freezers stocked as well as maintaining the condition of the product while it is being transferred from the locker plant to home-freezer cabinets.

Branch plants.--It has been mentioned earlier that many plants in rural sections cover an area with a radius of as much as 50 miles. This is too great a distance for patrons to travel every time they wish to purchase food or get something from their lockers. In many instances this difficulty has been overcome by plant operators setting up branch plants to serve outlying communities. Slaughtering and processing is done at the main plant, whereas the branch plant is used for lockers and to make available commercial frozen foods to patrons.

Plant Lay-Out

It has been estimated that more than 70 percent of the total operating costs of a locker plant consist of those for labor and management; depreciation and maintenance; and refrigeration. Each of these is affected by the arrangement and equipment of the plant and, therefore, much consideration should be given to these factors in planning a locker-plant lay-out. A possible lay-out and arrangement of facilities is shown in figure 96.

Lobby and office.--The lobby of the locker plant should be well lighted and large enough to permit orderly arrangement of facilities and expeditious service for the customers and patrons. Home freezers and other appliances which may be sold can be attractively displayed near the center of the room. Frozen food retail cabinets, a meat display counter, and other retail facilities for selling merchandise to customers could be spaced along the walls at one end of the lobby. Adjacent to the lobby at the other end could be the processing room, separated by a glass partition. The office may be located in a corner of the lobby next to the processing room, so that the office personnel can have direct contact with those doing the processing. This location is also convenient for waiting on customers and locker patrons.

An entrance from the lobby to the locker room might well be through a vestibule large enough to permit the outer door to close before the inner door is opened. A "remote controlled" recording instrument may be placed here that will record the temperature in the various refrigerated rooms.

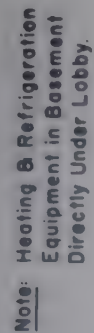


Figure 96.--Possible lay-out for locker plant that provides facilities for slaughtering livestock and wholesaling commercial frozen foods.

Locker room.--The size of this room, of course, depends upon the number of lockers to be installed. It is usually recommended that a minimum of 13 cubic feet be allowed for each locker. The aisles in the locker room should be wide enough for the drawers to open fully. Long aisles, 3 feet wide, and short cross aisles, 4 feet wide, are recommended by many operators. An alarm may be placed just inside of the door and connected to the office or cutting room for use in case a door becomes stuck or locked. Light-weight step ladders may be placed in each aisle of the locker room.

Bulk storage room.--The bulk storage room is located at the rear of the locker room. This storage is used for two principal purposes: (1) Where the plant is engaged in the distribution of commercial frozen foods, it serves as a storage for such supplies; and (2) in small towns where there is no public refrigerated warehouse, it can be used to store perishables for local hotels, restaurants, retailers, or anyone who has need for such space.

If expansion of the locker room is needed, it might well be made in the direction of the bulk storage room. At the same time, however, in planning a locker facility, space should be provided to expand bulk storage if necessary.

Holding room.--In cases where the locker plant is engaged in the wholesale distribution of commercial frozen foods, an order holding room might prove desirable. This room should be adjacent to the bulk storage room. It can be used for assembling frozen-food orders from the bulk storage room for customers.

Slaughter plant.--Before building the slaughter plant, the local and State boards of health should be consulted so that all sanitation requirements will be complied with. The city planning commission should also be consulted in regard to zoning regulation.

A place is usually provided near the slaughter room for holding both hogs and cattle. A knocking pen for stunning cattle and an electric or hand-operated hoist on a beam are the facilities needed in the cattle slaughter room. The slaughter of hogs requires a little more equipment. A hoist on a hoist beam, a sticking platform, a scalding vat, a gambrel table and a dehairer are necessary for this operation if the plant does much killing. An adequate drainage system for catching both blood and water is very important. Overhead rails, from the beef cradles and gambrel table, facilitate movement of the carcasses. A receiving platform for farm slaughtered animals may adjoin the slaughter room. An electric or hand-operated hoist is a useful device for removing the carcass from the truck and placing it on the rail. A track scale may be located between the platform and the chill room. This scale should be convenient for weighing carcasses of animals slaughtered in the plant as well as those brought to the plant by the farmer or packer.

Chill and aging rooms.--Approximately 0.6 square foot of space per locker is provided for the chill and aging rooms. The chill room need not occupy over one-third of this space. The overhead rails in the chill room are arranged in such a manner that a carcass may be brought directly from the receiving platform and then moved into the aging room or processing room with a minimum of trouble. The floors in the chill and aging rooms are of a rough surface and are sloped toward the drains or doors at a pitch of not less than 1 inch in 10 feet. These rooms are held at a temperature of 34° to 38° F. An air-blast is not recommended in these rooms as it has a tendency to dry out the meat.

Processing room.--It is important that the processing room be laid out efficiently, for it is here that a great percentage of the work is done. The floor space needed for this is shown in table 16. The overhead rail from the aging room may be sloped down from 10 feet 2 inches to 8 feet two inches to facilitate ease in handling at the block. The power saw should be adjacent to the block and the trimming table should be close enough to make the handling job easy. The wrapping table is placed so that the meat may be picked up from the trimming table, wrapped, stamped, and placed on trays with the minimum of lost motion.

Kitchen.--The kitchen is used primarily for processing and packaging fresh fruits and vegetables for freezing. The equipment should include a water heater, washing sink and work table, packaging tables, scales, and adequate shelves for placing utensils. The kitchen should be located near the front of the plant and convenient to the other processing room.

Table 16.--Size of processing room as related to number of lockers in plant

Lockers	Size		Considered desirable by some
	Minimum	Recommended	
	Sq. ft.	Sq. ft.	Sq. ft.
Up to 167	140	175	276
Up to 333	170	212	393
Up to 500	200	250	450
Up to 667	300	375	500
Up to 833	330	412	540
Up to 1000	360	450	590
Up to 1200	390	487	650

Source: Brown, H. D., Kunkle, L. E., and Winter, A. R., Frozen Foods Processing and Handling, S. F. Hinkle and Sons Company, 1946, p. 51.

Curing room.--Since the curing room and curing workroom are difficult to keep clean and free from odors, the walls should be finished in a smooth washable material that is durable and impervious to moisture. Floor space provided for this room usually amounts to 3 square feet per locker and floor construction is of a nonslip material. The overhead rail is usually run into this room as well as into the curing workroom. The temperature of the curing room is held at 36° to 38° F. Wooden bins are provided for storage of the meat during curing.

Curing workroom.--A curing workroom may be adjacent to the curing room. A table and a sink with hose connections for both hot and cold water are provided in this room. If the artery cure is used, a special pump and scales are necessary. In designing a plant, the curing rooms should be placed near the cutting room, since that is where the meat comes from, and yet, because of odors, it should be well separated from the lobby.

Smokehouse.--The smokehouse is usually located at the rear of the locker plant. An overhead rail should connect the curing workroom and smokehouse. Facilities for heat and smoke must be provided for in planning the smokehouse. Steel units are recommended by many operators because they occupy a minimum of space and can be installed as they are needed. These units are equipped with temperature and smoke-controlling devices.

Lard-rendering room.--The lard-rendering kettle and press may be in the same room with the curing facilities, or in an adjacent room. The same sanitation precautions practiced in the curing room are applicable in the rendering room, since the steam from the lard kettles will create a slimy condition on the equipment and the walls. Here, as in the curing room and locker room, floors should have a nonslip surface.

Insulation.--The greater part of the investment in a locker plant is in the insulation and refrigeration facilities. For the greatest efficiency, the refrigerated rooms should approach a square with the freezer and locker rooms surrounded by the 34° rooms. This allows the insulated walls to be used jointly, thereby cutting the investment and depreciation costs. The most common materials used for insulation are corkboard, regranulated cork, shredded redwood bark, mineral wool, rock wool, kapok, cotton, glass wool, and balsam wool. The thickness of the insulation depends primarily upon the temperature desired in each of the refrigerated rooms, the type of insulation used, arrangement of the rooms, and intensity of outside heat.

Refrigeration.--The two general types of refrigerants most commonly used in locker plants are ammonia and freon. The freon compressor is small and may be moved without too much trouble should the occasion arise, while the ammonia compressor is relatively large.

A condensor may be installed so that one unit will take care of the whole plant, but this means complicated control devices. Another method which is more simple is to use one condensing unit for the zero storage and another for the rooms held at 34° F.

HOME STORAGE FACILITIES

Importance

If frozen foods are to gain an appreciable share of the consumer's food dollar, there first must be adequate storage facilities in the home to hold small quantities of these frozen products. Consumer-size packages of frozen foods will thaw in 3 or 4 hours at room temperature, and in less than 15 hours when held in an ordinary mechanical refrigerator at 40° to 45° F. No matter how desirous the shopper is of purchasing frozen foods, the amount she buys is going to be small unless she has facilities for keeping them.

As yet most shoppers have comparatively little space at home for the storage of frozen foods. In many cases the only available space is in the evaporator of the refrigerator, which generally has a temperature of above 10° F. and is often filled with ice cubes or a small supply of meat. Therefore, with the housewife doing most of her food shopping only once a week, it can be seen that a prerequisite to an expanded frozen-food consumption is the presence in the home of some kind of low-temperature storage equipment.

Extent of Freezers in Homes

Since the domestic refrigerator was the forerunner of the home freezer, it is appropriate to discuss first the growth in the use of this facility.

There are very few industries that can boast of an expansion in the volume of sales over the past two decades comparable with that of household appliances. Among the large increases in appliance sales from year to year are those of the domestic refrigerator. The use of mechanical refrigeration to preserve the quality of fresh and cooked foods and to prolong their life began its spread into the home in the 1920's, soon after it was established in commercial fields. The use of the mechanical refrigerator has kept pace with the introduction of electricity into a rapidly increasing number of American households, until now it has become accepted as a necessity in our daily lives. In 1940, the Bureau of the Census reported 34,855,000 occupied dwelling units in the United States, of which 15,000,000, or 44 percent, were equipped with mechanical refrigeration. In 1947, the number of occupied dwellings was reported at 39,000,000 - a 12 percent increase over 1940. An estimate of the number of household refrigerators in use the same year was 28,000,000, a 90 percent increase over the 7-year period. ^{20/} It is interesting to note that this increase of the number of homes with refrigerators from 44 percent in 1940 to 71 percent in 1947 was accomplished in the face of wartime restrictions on critical materials.

^{20/} Based on figures supplied by the National Electrical Manufacturers Association.

It is estimated that the homes which today do not have mechanical refrigeration are about equally divided between those that have ice boxes and those that have no refrigerated facilities at all.

A further break-down of the 1940 statistics shows that 56 percent of the urban, 39 percent of the rural nonfarm, and only 15 percent of the rural farm homes had mechanical refrigerators. This low percentage of farm homes having refrigeration was due in no small part to the fact that only 31 percent of the farms had electricity. However, with the expansion of power utilities this percentage increased to about 69 in 1948. At the same time, there has been an increase in the number of urban and rural nonfarm homes having electricity.

The rate of increase in the number of homes with freezers has paralleled the rapid expansion of the number of households with refrigerators. However, this rate of increase has not been nearly so large as some of the early expectations. Some household refrigerators manufactured in recent years have frozen-food compartments that serve the same function as their larger counterparts--the home freezers. Although there are no accurate statistics available as to the number of home freezers, reports of the National Electrical Manufacturers Association indicate that there were approximately 1,200,000 freezer units of all types in use in the United States in the early part of 1949. This number started with only a scattered few prior to the war. A small number was manufactured during the war, and about 200,000 in 1946, and 400,000 in 1947. If the present trend of these appliances continues, each succeeding year will see a considerable increase in the number of freezer units in the home. No doubt the owners will seek to utilize their freezers fully by including increasing amounts of frozen-food items on the shopping list, provided, of course, that their initial contacts with frozen foods have not been disappointing because of poor quality or high prices.

Even though the expansion of freezer sales has been remarkable over so short a period, the homes with these units still represent only a small part of the potential market and the effects of these freezers on commercial distribution of frozen foods are yet relatively minor. It should be considered that a majority of the home freezers, particularly the larger ones, are located in rural and rural-urban areas where a sizable part of the contents of many of the units is derived from home or locker-plant products. Thus, it can be seen that commercial frozen-food sales are not yet dependent to any great extent upon consumers who have large quantities of home-storage space. But it does seem logical to assume that an increasing number of homes with freezer units, especially when these are urban homes, will lead to an increase in total commercial sales of frozen foods.

Servicing the Home Freezer

An important inducement to buying a home freezer insofar as the consumer is concerned would be for the housewife to be able to purchase large stocks of frozen foods at a discount from the retail price. In surveying about 150 large retail stores, it was found that only about

5 percent give the home-freezer owner a discount for purchasing in lots of a dozen. It is interesting to note that of the few grocery stores visited that are offering a reduced price for buying in quantity, practically all of them were large modern stores of the supermarket type. Other retailers were encouraging large purchases by offering a delivery service. Where this delivery service was offered by retailers, only in isolated cases was there a price-reduction incentive for quantity buying. On the other hand, there are numerous locker plants that are catering to families with individual freezer facilities by offering a discount on purchases of commercial frozen foods when bought in lots of a dozen.

One recent innovation in quantity buying has been the offering for sale to home freezer owners by some locker plants of institutional size packages of frozen fruits and vegetables. These packages are sometimes referred to as "economy" size packages and usually have net contents of $2\frac{1}{2}$, 5, or 10 pounds. Most of the vegetables offered for sale are products such as beans, peas, and corn that are loose frozen, thus permitting any portion of the contents, while still hard frozen, to be poured out of the container. Portions may be taken from packages of fruits and vegetables that are not loose frozen by breaking into desired sizes. When portions for immediate servings are removed from institutional size packages the remaining contents of the packages are placed back into the freezer. Purchasing large packages usually has the advantage of being more economical than purchasing the same kind of merchandise in smaller quantities and in small size packages.

Of the frozen-food wholesale distributors interviewed, about 10 percent indicated that they were frequently approached by people who owned home freezers for purchases of frozen foods in dozen or mixed case lots. Of these few wholesalers who had opportunities to sell direct to consumers, more than half stated that they had refused to make such sales and had discouraged further approaches by home-freezer owners. The opinion of wholesale distributors as to how the consumer is going to obtain stocks of frozen foods for home freezers was about equally divided into two groups. One group contended that the consumer would derive most of her supply, regardless of the size of the home unit, from direct purchases at the retail store. This contention was held with the stipulation that this would be the case even if retailers did not grant discounts for purchases in dozen or case lots. Distributors who held this view seemed to believe that the era of selective weekly shopping, where purchases of most household supplies can be made upon customer selection at large concentrated retail stores, will continue for a long time.

Another group of distributors believed that there is coming a time of compromise between selective shopping by the consumer and extra services by the retailer, particularly in regard to home delivery of staple and perishable foods. In this case, it is foreseen that a frozen-food home delivery service, with or without the inclusion of nonfrozen food items, will be the means of getting a large part of the supply into the home-storage facilities. In most cases when this attitude was expressed by distributors, the condition was made that there must first be widespread use of home freezers and refrigerators with suitable frozen food

storage. Also, the believers of this group conceded that there would always be a need for frozen-food sales at local grocery stores for those consumers who rely wholly or partially on selective shopping.

If the owners of home frozen-food storage facilities are going to demand that distributors (retailers or wholesalers) make frozen foods available on a mixed or straight case basis at a discount in price, there will arise the problem as to how this can be done. Many wholesalers take the view that if they start selling direct to consumers, they will be in competition with the retail stores to which they sell. As a result, the opinion seems to be that in a given city or locality, the wholesale distributor must either choose between serving the consumer direct or continuing to serve the retail store.

To the question of who is going to supply the home freezer with commercial frozen foods, the locker plant will perhaps prove to be a partial answer in rural and rural-urban areas. Some people are also convinced that a modified version of the locker plant will be prominent in frozen-food distribution in metropolitan areas, and in some areas these plants have already entered the field. During the war frozen-food lockers were established in the basements of apartment buildings in several large cities. Although these projects have been discontinued in many instances, some are still operating at profitable margins and the operators are very optimistic about their continued success.

Because all distributors are directly concerned with frozen-food sales and storage facilities at the retail level, the individual wholesaler has given very little consideration to increasing the number of homes with storage space for frozen foods. Until recently almost the entire job of selling freezers to the homemaker was left to the dealer of household appliances. Of the 315 wholesale distributors surveyed, less than 2 percent were actively engaged in fostering the sale of home freezers and refrigerators with frozen-food compartments. Only a few were actually selling and vigorously merchandising home-storage units. On the other hand, 23 percent of the wholesalers were either renting or selling cabinets from their own stock, for retail and institutional use. About 10 percent of the wholesalers reporting, however, were indirectly concerning themselves with increasing the sale of home-freezer units by an arrangement with appliance dealers whereby the frozen-food distributor would offer a small amount of stock free of charge (the usual amount was \$25 or \$50 worth, retail price), with the sale of each unit. Other frozen-food wholesalers have contributed to the sale of home freezers by telling consumers about these units when talking with and to local civic groups. In some cases wholesale distributors have enlisted the service of home economists to assist in merchandising at the retail level and have even gone into homes and institutions to promote the use of frozen foods and to give suggestions on equipment and food utilization.

Future Possibilities for Home-Cabinet Use

It is, no doubt, of interest to the members of the trade to know what the potentialities are for families to use frozen foods and what some of

the possibilities might be for increased storage facilities in the home. First, consideration should be given to the food requirements for individual families. Table 17 shows the amount of the different types of food that a family of four people who live on a moderate income is likely to consume. Like any other food plan, this schedule is subject to numerous conditions. In the first place, families with lower incomes rely more on the cheaper foods, such as potatoes, dry beans, etc., while families in upper income groups eat more of the foods in the expensive groups, such as meats, eggs, fruits, and vegetables. According to table 17 if a moderate-income family with a home freezer obtained 15 percent

Table 17.--A moderate-cost food plan for a family of four 1/

Food groups	Quantity of food for 1 week	Quantity of food for 1 year
	<u>Pounds</u>	<u>Pounds</u>
1. Milk (quarts) <u>2/</u> or equivalent in cheese, evaporated milk or dry milk...	49.50	2,574.0
2. Potatoes, sweetpotatoes...	9.75	507.0
3. Dry beans, dry peas, nuts.	.70	36.0
4. Citrus fruit, tomatoes....	10.50	546.0
5. Leafy, green and yellow vegetables.....	12.75	663.0
6. Other vegetables and fruit	12.75	663.0
7. Eggs <u>3/</u>	3.35	174.0
8. Meat, poultry, fish.....	9.50	494.0
9. Flour, cereals <u>4/</u> in terms of flour equivalent.....	11.50	598.0
10. Fats and oils.....	3.25	169.0
11. Sugar, sirup, preserves...	3.25	169.0
Total	<u>126.80</u>	<u>6,593.0</u>

1/ A physically active man, moderately active woman, a child 1-3 years and a boy 13-15 years.

2/ Equivalent to 23 quarts of milk per week or approximately 1,200 quarts of milk a year. One quart of milk weighs approximately 2.15 pounds.

3/ Equivalent to approximately $2\frac{1}{2}$ dozen eggs per week or 116 dozen eggs per year, estimating one dozen eggs as weighing 1.5 pounds.

4/ $1\frac{1}{2}$ pounds of bread is equivalent to 1 pound of flour.

Source: Helping Families Plan Food Budgets, Miscellaneous Publication 662, issued by the Bureau of Human Nutrition and Home Economics, Agricultural Research Administration, U. S. Dept. Agr. The food quantities recommended are in terms of foods as they are brought into the kitchen. Weights include some allowance for refuse such as rind, bone, and other inedible parts that have to be discarded.

of its food in frozen form the total amount eaten in a year would be 990 pounds (fresh equivalent). Unless the family patronized a locker plant regularly two-thirds of its frozen foods would likely come from groups 4, 5, and 6 (fruits and vegetables). The other one-third would probably come from group 8 (meat, poultry, and fish).

If a family with a home freezer has access to home-grown food products, their consumption of commercial frozen foods may be either increased or decreased. If the family froze a considerable amount of food products, it would seem, offhand, that consumption of commercial frozen foods would be decreased. Yet, by becoming accustomed to frozen foods, the family possibly might build up an increased desire to augment the home supply with commercial frozen foods. The factors determining which families will use frozen foods and to what extent they will use them are many and varied; therefore, it is difficult to project any reliable estimate as to what percentage of the average family's menu might be devoted to frozen items. However, discussed below are some of the factors that affect the extent to which homes will acquire freezer storage facilities.

Is there a convenience involved?--Does having and using a frozen-food storage compartment make the task of meal preparation easier, and, if so, enough to justify an additional household appliance? Does it save time, cutting down on the tedious job of food shopping, and eliminating other problems of "feeding"? A few observations made of these queries have indicated affirmative answers. In fact, it seems that the conveniences realized are so far-reaching that, as yet, only some of the more apparent conveniences have been brought to the attention of the public (fig. 97). There is a fertile field here for some comprehensive studies to determine, comparatively, the conveniences to a family owning a storage unit for frozen foods.



Is the facility economical?--If having a home freezer or other frozen-food storage facility meets the first requirement, many families in the upper income groups would not give the economical aspect much consideration. However, if large sales volumes of frozen-food storage units are going to be realized, the requirements of the middle- and lower-income groups must be given primary consideration.

Figure 97.--One of the conveniences of having a home-freezer unit is that large quantities of food can be cooked, packaged, frozen-stored, and later reheated and served. Above, a homemaker is putting a frozen block of home-packaged creamed chicken into a double boiler for heating and immediate serving.

Although many American families are willing to pay a small premium in order to obtain convenience and quality, there must be more economic advantages before the use of home freezers will become widespread. If an actual saving in total money spent could be realized and the initial outlay of capital is not prohibitive, a family might, over a period of time, come to accept the home-freezer unit.

Families in the lower- and middle-income groups, except for paying a small premium for convenience and improved eating, would definitely expect to realize an economic advantage if money were invested in frozen-food storage equipment. If no savings were realized from having a home freezer and eating more frozen foods, most families would wait until economies appear before they would buy.

Arguments have been advanced to the effect that home freezers and the use of frozen foods have brought savings to families. However, in cases where this point has been proved the influencing circumstances have been of the most favorable nature. If a home freezer is properly managed and the purchase of commercial frozen foods or the processing of home-grown foods is done wisely, there is a chance of the housewife offsetting the monthly power cost of operation and perhaps even amortizing the freezer unit through savings. But more thorough analysis would be required to determine whether or not and if so under what conditions families can own large freezer units, realize the convenience and nutritional value of frozen foods, and yet not have to pay an excessive premium for these benefits.

Use of Freezers in Urban Homes

In some instances, an urban family will not need a separate home freezer to use frozen foods. For the people who rely on their weekly shopping trips to supply most of their food needs, a suitable storage compartment in the household refrigerator might be adequate. It has been expressed by some urban families that in the beginning a compartment of 50 pounds capacity was only partly used, but as they became more accustomed to using frozen foods, the extent and variety of their stocks increased to the point where the section was well utilized and, in the case of large families, was found to be too small.

As previously stated, some of the refrigerators now going into homes are equipped with a special frozen-food compartment. These compartments range in dimensions from less than $\frac{1}{2}$ cubic foot to more than 3 cubic feet. Most of the popular models, however, have compartments of about 1 or $1\frac{1}{2}$ cubic feet. Assuming that frozen foods generally weigh about 30 pounds to the cubic foot, it is estimated that a compartment of about $1\frac{1}{2}$ cubic feet will hold about 45 pounds. The smaller frozen-food sections are usually part of the ice-cube compartment and although they may be labeled "frozen foods," the temperature at which they are held and their small size make them undesirable for storing frozen foods except for a very short period. In the event that an urban family desires space for larger quantities of frozen food, and this could happen where opportunities

are available for buying wholesale, it might well consider renting a locker at a nearby locker plant or if this cannot be done it may be advantageous for the family to purchase a small home freezer.

It is believed that a number of urban and suburban families who depend on commercial sales at retail for their frozen food supplies will purchase a home-freezer unit instead of replacing their refrigerator with a new one having a frozen-food compartment of sufficient size. In such cases, having a home freezer will probably be a luxury convenience and in many cases will not be used to its fullest economic advantage. The use of a home freezer has good possibilities where the suburban user freezes home-prepared products either from the home garden or from fresh produce bought in large quantities during the producing season, or where commercial frozen foods can be bought in quantities at a wholesale price.

It must be kept in mind that the modern refrigerator with the special compartment for frozen foods comprises only a small part of the refrigerators now in American homes, and that as more and more homes become equipped with facilities for holding a short supply of frozen foods, there should be a corresponding expansion of frozen-food consumption.

Many housewives who have had only a little experience with frozen foods will likely give them a try when they get refrigerators with a zero storage compartment, particularly if the price of the frozen foods is not too high.

Use of Freezers in Rural Homes

Some of the big opportunities of frozen-food expansion lie in farms, small towns, and middle-sized towns. In these rural and rural-urban areas the frozen-food locker plant has aided the development of frozen foods. Here the locker plant has been the foremost and in many cases the only storage facility available to families for holding frozen products. In these areas, commercial frozen foods have only supplemented in a small way the products of home and locker-plant processing. Distribution of the commercial product through locker plants or other small town agencies has been considerably short of the potential market. In small cities it is often difficult for a person to find quantities of frozen foods for sale. One of the reasons for this lack of expansion of commercial frozen foods in rural and rural-urban areas has been inadequate refrigeration facilities in the homes. As previously shown, the percentage of farm homes with refrigeration is less than for urban homes. On the other hand, the farm families with refrigerated facilities have been the most ardent users of some frozen foods, mainly because of the establishment of the frozen-food locker plant as a community institution and because of the opportunity of preserving home-grown products by freezing at home.

It is in these rural areas where consumers have found freezers to be most useful. In many cases the home freezer can be used to advantage in conjunction with the neighborhood locker plant.

In considering the potential frozen-food market on farms, it must be remembered that about 70 percent of the farm income is attained by 20 percent of the farm operators. Therefore, there is a large segment of the farm population whose income is not high enough to permit them to buy a home freezer, even if it should in the long run prove to be a profitable investment.

Although the frozen-food compartment of a household refrigerator might be sufficient for the small urban family, the rural and suburban home frequently can use to good advantage considerably larger freezer facilities. The size and arrangement of such a unit depends on several factors. The first factor is the extent that the housewife is going to process and freeze food products. The next is the chances for locker plant affiliation. In many cases it is most desirable to use a small home freezer in conjunction with a locker rented at a nearby plant. However, under some conditions, especially where locker plant affiliation is inconvenient, larger farm-freezer units will be appropriate. In cases where the farmer slaughters large amounts of meat for freezing or where he supplies the local market with fresh produce, a cooler unit might also be desirable.

If a home freezer is to be utilized to its maximum, the processing of much of the meat and winter vegetables should be done in the winter when the previous spring's supply of fruits and vegetables is running low. A consumer should allow for at least two complete turn-overs of the capacity of the unit each year. In other words, a family of four might consume as much as 1,400 pounds of frozen products in a year. Unless it were imperative that over half of this be stored at one time, a turn-over of twice a year would indicate need of a freezer with a net capacity of about 700 pounds or at 30 pounds per cubic foot, a 20-cubic-foot freezer.

For the distributor of commercial frozen foods it might be well to remember that even though rural and suburban owners of home freezers will rely on their own supply of frozen foods for a large part of their stocks, they will become users of commercial frozen foods. Some housewives in rural areas who sparingly bought commercial frozen foods prior to purchasing a home freezer have found that a considerable part of their yearly stock has been in the form of commercial frozen foods bought at the grocery store or at the parent locker plant.

Some Factors to Consider in Purchasing a Freezer

A home freezer, well adapted to a family's needs, might well be a faithful family servant, with very little upkeep for a period of many years, but purchasing even the lowest priced unit on the market constitutes an investment worthy of careful consideration. Dissatisfaction with the home freezer can very easily lead to dissatisfaction with frozen foods.

After a decision has been made by a family to purchase a home freezer, the following points might be kept in mind when choosing a make or design and having it installed in the home.

(1) The size selected should depend primarily on such factors as size of family, methods of purchasing foods, the amount of home processing to be done, and whether or not a locker is rented at a nearby locker plant.

(2) It must be capable of storing frozen foods at a near constant temperature of 0° F.

(3) If the consumer is going to use the unit to freeze considerable quantities of foods, the cabinet should be built to perform this function and yet hold the foods already frozen at a constant temperature.

(4) The size and design of the cabinet (fig. 98) should be such that it can be put in an easily accessible place.

(5) The floor space that is available and the weight capacity of the floors can be important factors in determining the maximum-size cabinet that can be bought.

(6) Basement locations, if humid, are undesirable. Continual moisture on the exterior of the cabinet can cause fast deterioration of the metal.

(7) If convenient, place the cabinet in an unheated room; this reduces the cost of operation.



Figure 98.--Two types of home-freezer units are the chest (left) and the upright (right). Although the chest type has been more popular and generally comes in smaller sizes, the upright affords easy access to the products stored. Large freezers are usually located in the garage or basement, whereas, small ones are put in the kitchen.

(8) Cost of operation is important, especially as regards the amount of electricity the unit will use over a given period.

(9) Parts should be easily obtainable whenever needed.

(10) Written guarantees by the manufacturer, especially covering parts and labor, should be obtained from the dealer.

(11) Have the home power checked by a competent electrician whenever the installation is made.

(12) Caution should be taken to check for leaks at the door seals. These leaks will cause the door to stick as well as cause a rise in energy cost.

(13) A warning signal is desirable to give notice to the household when electric current fails or when for any other reason the temperature rises above a "safe" level.

(14) Be sure to have the dealer furnish defrosting instructions.

The smallest home freezers made in large quantities have a capacity of about $3\frac{1}{2}$ cubic feet. The larger sizes of chest and upright types run up to as much as 100 cubic feet. About 100 cubic feet, it usually becomes necessary to resort to the walk-in type of farm freezer. Frequently these large farm freezers are sold in conjunction with coolers.

It is often thought to be cheaper for a rural family to build a freezer than for them to buy one if the needs are above 30 cubic feet. Usually the larger the unit required the more reason for building a home freezer. The home-built freezer frequently allows farmers in the lower income brackets who could not otherwise afford one to have their own freezers. Because of the opportunity to use more insulation in the home construction, it is often cheaper to operate, provided good construction work has been done.

CONCLUSIONS

During the past several years the frozen-food industry has overcome many obstacles which might have prevented it from becoming a major industry. Today it is in a stronger position to expand than it has ever been before. Consumers are more conscious than formerly of the freshness, high nutritive value, convenience of preparation, favorable keeping qualities, and other appealing features of frozen foods. From the standpoint of the farmer, the marketing of perishables in frozen form offers new opportunities. It opens up the possibilities of expanding market outlets through a new use for farm products. Farmers, in potentially good growing areas and convenient to freezing plants who have previously been at a disadvantage because of distance to large markets and because of harvest seasons unfavorable for competing on the fresh market, are able to diversify production to include products for freezing. Furthermore, as freight rates have increased, producers far removed from markets are becoming more interested in processing products in the producing area in order to hold down their transportation cost.

Firms engaged in processing, distributing, and marketing are largely responsible for the rapid increase in the production and consumption of foods in the frozen form. However, in order further to increase market outlets many factors must be considered by producers and distributors. If frozen foods are to compete with other products in tapping the mass market, production must be large enough and the cost of marketing low enough that the frozen products can be sold to the consumer at a price which she is willing to pay and, at the same time, allow for reasonable returns to the producer and to those engaged in the essential marketing services. Not only is it important that a good product be grown and its quality maintained throughout the marketing channel, but a great deal of effort must be exerted toward improving the efficiency of handling facilities and methods of marketing. To accomplish these objectives the following points as revealed by the study need consideration:

1. Location of processing plant.--It is, of course, important that processing plants be located convenient to the source of supply. This creates a problem because many of the items best suited for freezing have very short harvest seasons in any area where they are grown. To meet this difficulty many processors have located plants in areas where more than one product could be grown for freezing and, at the same time, have encouraged farmers in the locality to produce other crops suitable for this purpose. Machinery and operations in the packing plant have also, in many cases, been adapted to handling a variety of crops.

However, there is still much that needs to be done along the line of studying diversification of production for freezing. With the heavy investment that is usually required for setting up a processing plant it must be used to a reasonable capacity if costs of frozen foods are to be reduced appreciably at the packing end.

2. Transportation.--The need for additional safe, low-cost transportation of frozen foods is one of the major problems facing the industry today. Although rail facilities are constantly being improved, there are

still very few cars available that are so insulated and refrigerated that they can hold low freezer temperatures. Consequently, long-distance rail shipments of most frozen foods are at temperatures considerably above 0°F. This condition, in many instances, damages the quality of the product.

As in rail transportation, the trucking facilities are still inadequate to meet the needs of the frozen-food industry. Although in many instances the temperatures attained by refrigerated trucks are lower than those attained in rail cars, many trucks carrying frozen foods fail to keep the temperatures on long hauls down to 0°F.

Storage-in-transit arrangements and the cost of such privileges need examination in an effort to attain maximum flexibility in distribution, to insure a wide choice of storage facilities to be used, and to minimize the cost of handling.

3. Warehouses.--A frozen commodity during its "life" stays in a warehouse perhaps longer than at all other places combined--plant, store, etc. Thus, the effect of storage on the quality of the product and on the cost of marketing is of extreme significance. Not only is it necessary that warehousemen furnish the proper storage environment as regards temperature, humidity, and sanitation, but it is equally important that the facilities are structurally adapted and arranged geographically to promote the efficient flow of frozen foods from producer to consumer.

Although there is adequate warehouse space to take care of immediate expansion in the frozen-food industry, there is some question as to the most efficient geographical arrangement of these facilities. In certain distribution centers there is a problem as to the adequacy of warehouse space suitable for the efficient handling of frozen foods by wholesale firms. It is apparent that much of the future of the frozen-food industry is dependent upon the proper design of warehouses and the methods of handling. Further consideration should be given to finding out when it is more economical to use public warehouses and when the construction of space by the frozen-food distributor is warranted.

4. Wholesalers' plant lay-out.--There is much room for improvement in the facilities and methods used by wholesalers. For a number of reasons many wholesalers do not have efficiently designed plants. First of all, the industry grew rapidly during World War II, when building materials could not be obtained. Another reason is that since the frozen-food business is so new, the volume handled by a firm frequently has not been large enough to justify building a new plant; therefore, makeshift arrangements have been made. However, during the past year a number of plants have been constructed.

In selecting, improving, or designing facilities for a wholesaler's plant, rooms should be arranged in such a manner as to bring about maximum efficiency in the moving of frozen foods into, within, and out of the plant. The plants should include a space for trucks and platforms at truck-bed height for the efficient loading and unloading of delivery trucks. Where the plant receives a large quantity of frozen foods by

rail, a railroad siding should be provided in order to cut down on cartage costs.

In many instances the wholesale plant is located some distance from the local warehouse that handles its long-term storage. At the same time, the plant has little or no room to hold supplies for operations over short periods; consequently, the wholesaler must make frequent trips to the warehouse. Obviously, the cost of frozen-food wholesaling could be lowered through the elimination of cartage and extra handling if more wholesalers had efficiently designed and properly located plants.

5. Delivery.--The trucks, methods, and facilities used by wholesalers and others in delivering to their customers play an important part in determining the price and condition of the product when it is purchased by the consumer. Frozen-food trucks should be refrigerated, especially when delivering to the retail trade and to much of the institutional and industrial trades. However, in many instances today, frozen foods are being hauled in uninsulated delivery trucks for several hours without any type of refrigeration. Improvements could be made in the methods of refrigerating trucks, in the ways of insulating them, and in the body design.

Much has been said for each of the two main methods of selling frozen foods--wagon sales and advance sales--but it seems that each method has its particular advantage under certain circumstances. There is need in the field of delivery for research to determine what methods and facilities are best.

One factor that influences to a great extent the cost of delivery is the location of the wholesale plant in regard to outlets. A wholesaler who caters primarily to the retail trade might well locate his plant either on the outskirts of town and deliver to retail stores in "palm-shaped" fashion or at a central point from which there are adequate streets to reach the retailers, thus avoiding delays caused by passing through congested traffic. The actual location selected should be the one most accessible to his customers. The question as to whether the location for the frozen-food wholesaler should be in the produce market district depends on:

- (1) Whether the wholesale produce market district is centrally located and accessible to retailers.
- (2) Whether the facilities in the produce market are broad, complete, and efficient.
- (3) Whether adequate space in such an area is available for the frozen-food wholesaler.
- (4) Whether the frozen-food wholesaler performs other lines of business and makes sales to buyers who visit the produce market district.

6. Retailing.--The growth and expansion of frozen foods, especially in the immediate future, depends largely upon how they are handled and

merchandised at the retail outlets. Frozen foods are well adapted to the self-service system, but to expand sales in retail stores will require improvements in retail displays, self-service cabinets, merchandising, consumer education, and competitive pricing.

Until frozen-food sales increase considerably, the job of merchandising at the retail store will rest primarily upon wholesalers. They should be prepared to advise retailers on the type and size of cabinets to use and the best methods of arranging and displaying the merchandise. Marking the price on packages and keeping the cabinet orderly have been universally neglected in all types and sizes of stores.

In observing the over-all picture of frozen-food marketing it seems that economies of distribution can be realized if retailers provide some short-term storage space at their stores. This would reduce the number of deliveries necessary by wholesalers, and minimize the extent to which wholesalers will have to break wholesale cartons to furnish retailers less than a case of a commodity.

One important question yet unanswered in frozen-food retailing is - Who is going to supply the owners of home-freezer cabinets with merchandise? In some areas locker plants have partially answered this problem with their complete line of commercially frozen foods and locker-plant-frozen meats. It seems that any outlet, including retail stores, that will sell frozen meats and other frozen foods in quantity for a price discount will increase his patronage from owners of home freezers.

7. Institutional and industrial users.--Although the Nation's numerous public and private eating establishments and the many industrial producers of manufactured foods use large amounts of frozen foods each year, their capacity for such use is yet to be fully developed. Many of these firms do not use frozen foods for the following reasons: (a) Custom - many chefs hesitate to deviate from their proved and tried foods and methods; (b) lack of storage facilities - in order to realize flexibility in preparing meals or foods such as pies and preserves, institutional and industrial concerns need some kind of freezer-storage units on their premises; (c) price - in some cases and with some frozen foods price can be a prohibitive factor, but it is usually overemphasized because of failure to consider some offsetting savings.

8. Locker plants.--Although many think of the frozen-food locker plant as being exclusively a rural institution and although at one time this might have been true, it is not the case today. In fact, many small-town locker plants that are less than 10 to 15 miles from larger cities report an increasing number of urban patrons. Just why frozen-food locker plants are more common in cities in some sections of the country than in others is not clearly understood. One factor which may influence this trend is the nearness of the city to prominent producing areas. Probably the best potential for expansion of business of many locker plants lies in the increased sales of meats and commercially frozen foods to home-freezer owners. In fact, as the situation is today, the locker plant is about the only institution able to cater to the home-freezer owner with a complete line of frozen foods and to sell them

in large quantities at a discount from the usual retail price. This advantage has given impetus to the construction and operation of locker plants in urban areas.

Two common faults found in locker plants are: (a) The inefficient arrangement of facilities and equipment and (b) the failure to use the best packaging materials or methods. Although the former tends to increase the cost of doing business, the latter endangers the high quality of the original fresh product. Although it may cost more to work with the best packaging materials, it is believed that customer satisfaction will more than justify the additional expense.

9. Home storage.--Undoubtedly much of the future expansion of the use of frozen foods depends upon the availability of some freezer space in the home--either separate home freezers or freezer space in household refrigerators. And yet, if families that have home freezers are to get full benefit from their investment, they must have access to a full line of frozen foods, including meats, and must be able to purchase supplies at a quantity discount. Certainly much more information needs to be developed that will enable the homemaker to get the most out of her freezer unit, because for every owner who knows how to use one well, there are several who do not. Since the increase of home freezers in American homes depends on the knowledge that people have of their use, it would seem desirable for the frozen-food and appliance industries to develop an educational program at the levels where it will do the most good.

10. Materials handling.--One of the principal reasons for the high cost of marketing frozen foods is the unnecessary handling of products in the distribution process. Although some of this excessive handling is the result of the complexity of the marketing structure, much of it is caused by inefficient handling equipment and techniques. Processors, warehousemen, wholesalers, and others frequently can reduce their cost through use of labor-saving machinery, such as hand trucks, skids or pallets with lift trucks, conveyors used alone, and conveyors used in combination with other apparatus. There is need for further study to determine under what conditions it will pay to use such equipment. In each instance the equipment to be used by a firm depends on his plant lay-out and the type of packages handled. A general study to determine the relative merits of these kinds of equipment in handling various types of packages of foods is now under way in the Marketing Facilities Branch.

11. Packaging.--Frozen-food package sizes create a problem all the way from the processor to the consumer, and systematic research is needed to solve it. At every stage of distribution there is the question of what are the best sizes and types of packages or cases for convenient handling. The processor has the problem of using the type and size packages and packaging machinery that will speed up his operations. The assembling of mixed cartons of merchandise at the wholesale plant is basically an uneconomical operation. It is desirable for wholesalers to deliver in case lots. However, cartons that may seem to be the most economical for the wholesalers do not always fit the needs of the retailer. The retailer has the problem of not getting overstocked with

certain items and yet, at the same time, he must maintain a full line of frozen merchandise if he is to get full use of his cabinet.

At the consumer level there is also the question of the proper size of individual packages of the various commodities for family use. It appears that a large economy-size package of frozen foods can be developed, especially for home-freezer owners. Oftentimes the small retail package does not fully meet their needs. With some vegetables the $2\frac{1}{2}$ -, 5-, or 10-pound institutional-size packages may be even better suited for the home-freezer owner than the conventional retail-size packages, provided the contents are loose frozen or easily broken when in solid block. There are these and many other problems which require more information to determine the most practical materials and methods for packaging frozen foods.

12. Marketing information.---Although some market information is available for members of the frozen-food industry to conduct their business on a well-informed basis, there is an apparent need for more timely and complete information on production, storage holdings, consumption, and prices. Producers are frequently unable satisfactorily to determine their production program for the year because of a lack of information on current stocks that are available for different uses, and consumers have been unable at times to get the products they desire because the supply has been exhausted before the end of the year. In order to aid in the development of a satisfactory production program for frozen-food packers, to assist in the financing of the production and marketing operations, and to make certain that as large quantities of the various types of food are packed as will be used by housewives, restaurants, institutions, and processors, it is necessary that methods be perfected to acquire and disseminate additional statistical information on production, stocks, and movement of frozen foods in the marketing channel. A study to determine the kinds of market information most needed and the methods for obtaining it is now under way in the Marketing Facilities Branch.

It must be remembered that the price, quality, and condition of the frozen foods when used by the ultimate consumer determine the success of the entire industry. Inefficient operations and improper temperatures anywhere along the line will impair consumer acceptance of merchandise that was originally a quality product processed and frozen. There must be no weak links in the distributing chain.





peddy
23/4A7

Call No. F8,3-0(26;c)

N49

CHECKED
2008



<i>Due Date</i>	<i>Return Date</i>	<i>Due Date</i>	<i>Return Date</i>

